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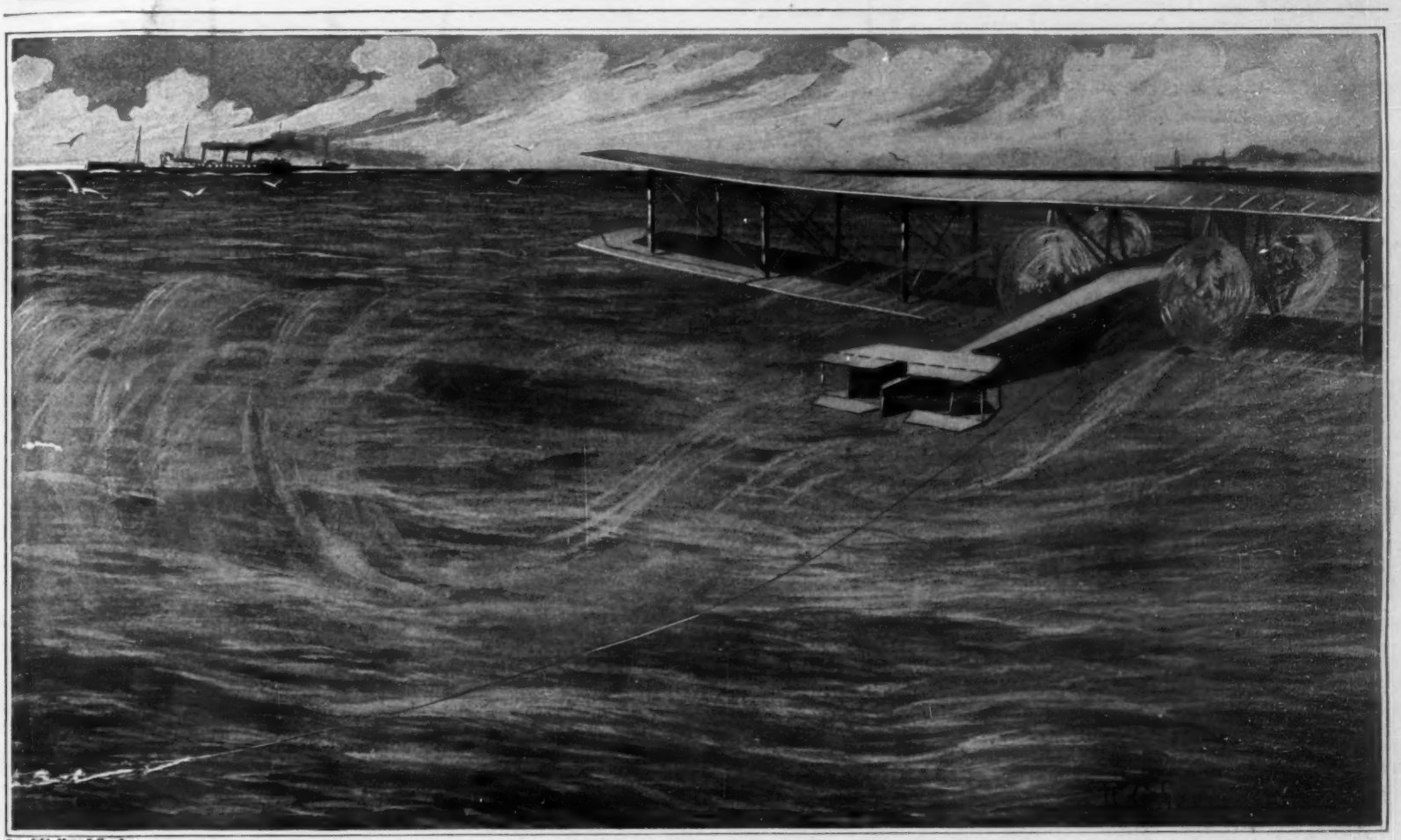

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Our artist's conception of the trans-Atlantic airplane towing a mechanical log as a check on the navigator over the trackless course of the ocean

A Navigational Safeguard for Trans-Atlantic Flight

By Robert G. Skerrett

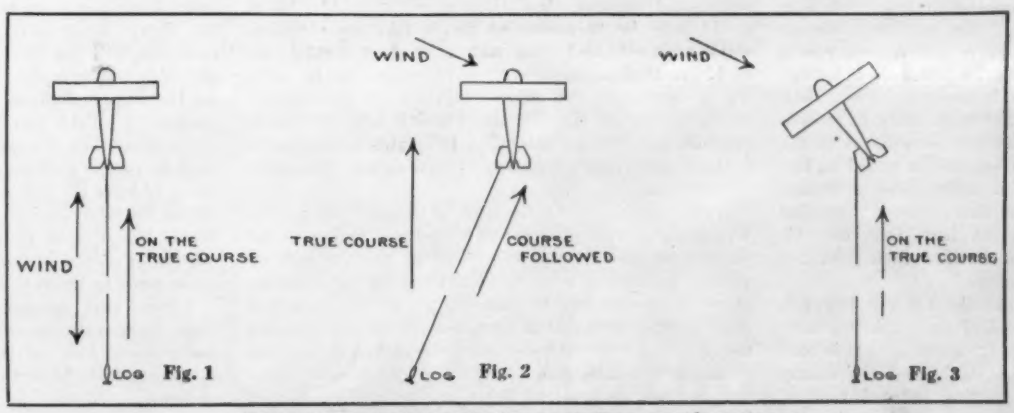
TRANS-ATLANTIC flight is mechanically practicable. The grim necessities of war have led to the evolution of bombing planes equipped with motors capable of maintaining a continuous air passage from the shores of America to points on the coasts of Europe. Pilots both here and abroad stand ready to make the trip at any time; and in these particulars there is nothing to hamper the essay. Even so, there is a real difficulty that must be mastered in order to make success sure and not just mere chance. The problem of navigation is the outstanding obstacle at the present moment; the man at the helm, so to speak, of the cross-ocean machine must be able to steer with confidence the course chosen for him, and, contrary to general belief, his situation is decidedly different from that of the mariner.

This state of affairs is not an unexpected one, nor have the experts been lacking in efforts to meet the conditions imposed. Navigational aids of various sorts have been invented and developed to measurable degrees of efficiency, but until very recently none of these has met squarely or promised to solve the really outstanding difficulty, that of reliably accounting for the drift or leeway of a plane impelled laterally by atmospheric currents sweeping across the craft's intended course. A ship pursuing her way upon the sea is in touch with Mother Earth, so to speak. The hydrographer has determined with considerable nicety the speed and direction of established ocean currents, and the man on the bridge allows for these and also for the stimulating or retarding effects of changeful winds. Further, because of his hold upon the water, the mariner is able to gage with accuracy the force and the direction of the stormy blasts which may tend to drive him sidewise from his chosen path.

The airplane, on the contrary, is suspended in a medium which permits of motion in every direction, and is therefore a plaything of the winds. No matter how fast its engines may drive it forward, seemingly in the direction desired, its actual line of advance, if influenced by lateral air currents, is the resultant of the propulsive force of its propellers and the sidewise thrust or drift induced by the wind. The consequent course may, accordingly, be one pointing many degrees away from the intended objective; and the longer the disturbing air currents act and the greater the distance to be covered the farther away the flying machine will be carried from its prescribed destination.

When flying over land, with easily discernible topographical features, the air pilot gives little heed to the action of the wind save, from time to time, to swing his machine to right or left far enough to bring him back into line with some prominent landmark. By following a more or less zigzag course he thus reaches his chosen position. But the trans-Atlantic aerial navigator cannot rely upon a procedure of this sort. He has beneath him the flat and tractless surface of the sea—he has no point of contact by which to determine the actual direction and the force of the wind that may be setting him off his true course. To be sure, he can descend near enough to the water to observe the parallelism of the waves and, by means of an ingenious mechanism, check up his course by that index of wind action; but this is a rough approximate, for it does not take into account the general subsurface movement of the ocean which will vitiate the superficial guide. Finally,

(Concluded on page 113)



Suggested method of navigating an airplane over the water

Fig. 1 illustrates airplane holding to the true course whether the wind be from straight ahead or from directly astern. Fig. 2 shows how the log line would indicate the degree of drift due to a lateral wind and the course that the aircraft would actually follow when heading upon the correct compass course. Fig. 3 shows how the airplane would head to offset the force of a lateral wind when actually advancing upon the true compass course. In this case the log line and the true course are parallel.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Can Germany Be Crushed in the Air?

SENATOR JAMES A. REED, of Missouri, a member of the Senate Military Sub-Committee on Aviation, has introduced a bill in Congress which deserves the most earnest consideration. Its object is to establish a central control of all aircraft activity and production. It is probable that this will involve the creation of a new Cabinet position, and that such an officer would have full powers to direct, advance, and bring under his control all the aerial needs of the service.

As time has elapsed the necessity for such a unified and supreme control has become more and more apparent. Mr. Ryan, the new head of the production end of the program, has been most efficient and has demonstrated the need of allowing to the heads of departments power in carrying forward their work. In Great Britain a separate board of this character has been found to be absolutely essential to the proper advancement of aerial service; and in January of this year the British established such a department of their Government with most gratifying results. Its head should be independent of the Army and Navy Departments, although coöperating with them in bringing about the very best results for both branches of the service.

In England it was found that there was jealousy between the Army and Navy and duplication of their work with confusion and loss of efficiency. It is for us to profit by this experience and thereby secure the best interests of the Allies, as a whole. As a matter of fact, the proposal is not altogether new, for the subject was debated in the Spring of 1917 in the congressional committees. It was turned down apparently for no better reason than that it was novel; Congress, being new to the game, was inclined to move with caution.

General Brancker, who is at the head of the British Commission in this country and who has just returned to England, advocated very strongly the creation of such a department, and he further urged that there should be, in connection with the Department, a resident Head Commissioner abroad who would be in close touch with the latest developments of the art, both in France and England. Such a course as this seems to be imperative to the best solution of the difficulties; but it would be necessary, in order to make his position effective that this official should be endowed with almost supreme power. At all events the present step is a move in the right direction and it is to be hoped that the bill in question will not be allowed to die of inanition.

Before General Brancker sailed, in several public utterances he pronounced the Liberty Motor to be probably the best of its kind, and said its performance had been most satisfactory. He stated that England had placed a large order in America for this motor, only part of which had been filled, and that they had in storage in England several thousand planes which had been built for the reception of this particular motor. He stated that the non-delivery of the motors was a serious embarrassment and that he believed, if a large number could be sent in the immediate future, they could be fitted to the planes that were ready to receive them, and could be used before the season was so far advanced that extensive aerial operations would be impracticable. We should ship as many Liberty Motors as we can spare at the present time without depriving our own forces. We believe, in fact, that the Air Production Board proposes to forward each month a substantial number of these motors.

It should be remembered that the Liberty Motor is used principally on bombing machines. This is one of the most important branches of the service, as it is used largely for reaching distant points behind the enemy lines, with the object of destroying railroad centers, munition plants, ammunition depots, and bombing the Rhine cities. General Brancker believes that in the near future it will be possible to reach Berlin.

The French and British state that they can supply all the swift combat planes that are necessary, and they ask us to specialize on the powerful 12-cylinder Liberty Motor and on planes for observation, surveying and photographic purposes for the use of General Pershing and his men. It should not be forgotten that the production of airplanes in Germany is on an enormous scale, and it has been stated on good authority that it perhaps equals the present production of the Allies. Lord Weir, head of the British Air Ministry, stated that during the past year the British destroyed 4,106 enemy planes, and lost only 1,217 machines during the same period. This is a most satisfactory showing. It is understood that although the British hold supremacy over their own line in France, the same is not necessarily true as far as the French and American line is concerned. This situation, however, will be changed before the beginning of the coming year. It is hardly conceivable that at that time the Hun will hold a very comfortable berth in the air.

Although the German production has been on a very large scale, and the Gotha and some of the other machines are recognized as being of a high order, it is not believed they are of as good a type as those now being used by the Allies; nor is the German aviator, on the average, considered the equal of the airmen of the Allied fleets.

Hoist with Their Own Petard

THE German mind is a wily and devious organism. Its instincts are all those of indirection. If there is any sly and underhand way by which its owner can approach its goal, it may be depended upon to take him by that route, rather than over the direct path toward his objective.

Sometimes this studied cleverness is wholly successful—it actually gets the Prussian to a place which he could not otherwise have reached. More often it presents, to the German, the aspect of success, but is in reality, to an unprejudiced observer, the height of absurdity, because the German could so easily have attained, by a direct means and at far less effort, the thing which he worked so hard to achieve by indirection. And sometimes, we rejoice to say, the Hun actually outreaches himself in guile, and his very cunning acts as a boomerang.

A most delightful instance of this is before us. The German judges others by himself. He knows full well that his Fatherland is a robber nation, ever seeking how it may prey upon the helpless. Specifically, he knows that if at any time it seemed worth while to do so, his precious government would produce a new ruling or a new law or a new precedent which would render inoperative the patent protection extended in and by Germany to non-Germans. So he naturally infers that other nations suffer from the same opportunistic impulses, and are only awaiting a favorable moment to deprive German subjects, by pseudo-legal means, of the protection which has been accorded them and the wealth which has accrued to them by virtue of their patent rights in England, France and America.

So the wily German consulted with his lawyers and his technologists and his diplomats and his bankers—it requires such a conference to start anything in that government-ridden land—and between them all they found what looked like a way out. The patents which they really prize are those in the chemical field, by means of which they have maintained such a grip upon so many of the world's industries. What was needed, according to the Germanic point of view, was some means of rendering these patents ineffective in the hands of any others than the German holders.

At this juncture some inspired son of Kultur made his inspired suggestion. The "idiotic Yankees" and the "stupid Englishmen" and the "decadent French" would never think of testing out a German patent to see whether it worked. They probably wouldn't know how to set about the test, even if it occurred to them. In any event, they would understand that there would be no sense in their doing so, because they knew perfectly well that German efficiency could make the goods better and cheaper than they possibly could. So it would only be necessary to file a fake specification, which pretended to but did not cover the actual process used. As long as the patent was recognized in the country of issue, the deception would remain undetected; and as soon as the silly foreigners took it into their heads to invalidate German patents or to legalize infringement of them, they would discover, to their sorrow, that none of them would work.

Such must have been the train of thought followed by a large proportion of Germany's chemical houses in the decades previous to the war. For the fact, as now revealed, is that a very large number of the German chemical patents filed in this country are incomplete or fraudulent. An essential ingredient or an indispensable step has been omitted from the specifications, or has been replaced by a false step or ingredient, or in some other way the process involved has been doctored up so that it cannot be performed, as described, to secure the alleged result.

The deception thus practiced on a wholesale scale has indeed remained undetected until the present time. For a chemical patent is not like a mechanical one; it does not bear on its face indisputable evidence of its practicability and good faith. And, once the patent was issued, the German idea worked out to perfection; why should an American manufacturer bother his head trying whether he could carry out a process which was patented by another in this country?

But with our entry into the war, the status of the German-held patents in this country changed; they became at once the object of great interest on the part of many American firms. Efforts to carry out the processes described in them were made on all sides; and on all sides failure resulted.

So much was in accord with the German program. But strangely enough, at this point we introduced a program of our own. Instead of sitting down to weeping and wailing and gnashing of teeth at their inability to make the German patents work, our chemists at once addressed themselves to finding out why they wouldn't work. And since American chemists are better than the best which Germany can show—they have proved it time and again since 1914—it was not long before German patents were being reconstructed, correctly, on all sides and by the hundreds. Right now we are using many such patents in the course of our normal and our abnormal industry, and bringing more into use every day.

Perhaps, after all, the Germans anticipated something like this; though they could hardly have been prepared for such a prompt and complete unraveling of the tangle which they had set us. But—there is an aftermath of the affair for which they could hardly have been at all prepared.

An invention is patentable only if it is useful. It is useful only if it is operative. And it stands or falls, finally and definitely, upon the specifications and claims. Accordingly all these German patents, which will not do what they claim to do, are invalid; they are without standing. Any American who can discover the true formula is privileged to use it, without regard to the fact that there is an alleged patent on it. And this use of the true formula, before a patent application has been filed on it, would probably prevent its being patented in this country by the German discoverer. So the clever Germans are left without their precious patents.

More yet—suppose an American finds out the true formula behind one of these fake German patents, and then asks his patent attorney what to do about it. The only advice which can possibly be given is, "Patent it!"

Need we point out the delicious sequel? The end of the war will see prodigious efforts on the part of Germany to reëstablish her chemical hegemony in this country. But at every turn, if our manufacturers are alive to their opportunity, she may be confronted by American-owned patents covering German processes and products—processes and products developed in Germany after years of patient research. The German owners of such processes could then use them in this country, for import their products into this country, only after paying fat royalties to the enterprising American rediscoverers of the true formulae!

Germany's industrial pirates are far-seeing men; but here, surely, is one instance where their vision was myopic. A more complete overthrow of the villain, a more soul-satisfying triumph of virtue and innocence, could hardly be found in all the world's melodramatic literature.

Another Bond Broken

AMONG the chemical products which have been imported in considerable quantities from Germany for consumption here, tartar emetic has always held a place. It is used, pharmaceutically, as an expectorant in bronchial diseases, and commercially as the fixing agent for basic aniline dyes, for fastening the colors to textile fabrics, leathers, and the like.

Now tartar emetic is, chemically speaking, potassium tartrate of antimony; so for its manufacture potassium salts of some sort are required. That is why Germany has always supplied it; that is why we cannot supply ourselves, now that German trade is cut off. The extent to which we normally require this material is indicated by the import figures, which show, for 1913, 120,000 pounds; for 1914, 185,000 and for 1915, 250,000.

Granting that we cannot find the potassium for the manufacture of sufficient of this material along accepted lines, we have the alternatives of developing a substitute calling for no potassium at all, or one calling for notably less of the difficult element. In other words, we may hope to displace potassium entirely or partly by other compounds in the making of a tartar emetic substitute.

A New York chemist has attacked the problem along these lines with success. As might be expected, he has replaced most of the potassium by sodium, giving a lacto-tartrate of sodium and calcium combined with antimony. It then turns out that the percentage of available antimony is double what it is in tartar emetic, so that the new product is superior to the old, alike on theoretical grounds and in the practical trials of many cotton dyers and print works using it. So German tartar emetic will hardly be able to regain its lost position.

Naval and Military

Anti-Submarine Mine Fields.—In speaking recently of the great mine fields in the North Sea, to which reference has been made in the SCIENTIFIC AMERICAN, Sir Eric Geddes stated that these mine fields, which reach from Norway to the north coast of Scotland, are gradually hemming in the enemy submarines. He drew attention to the barrage of mine fields across the Straits of Dover and the mining operations which have been carried on in Heliogoland Bight. The mines in the Bight have been laid by some of the fastest and finest craft of the British Navy, which have gone into the Bight at night to lay them. It is rarely that a German U-boat attempts to break through the barrage at the Straits of Dover, which has proved to be highly efficient.

Thrift Versus Economy.—Under this heading the *Marine Journal* quotes the case of the Pusey & Jones Company which has created a Salvage Division of the Maintenance Department to collect scrap metal and other waste products in its three yards. The moral is drawn that this is one more instance of what the war is teaching Americans. The habit of thrift, it is pointed out, is different from that of economy, although many people confuse the two. The former is using all that you have to the very best advantage; the latter is frequently as much a loss as a gain, since to practice over-strict economy may be productive of a narrow outlook on life and may serve merely to defeat its own ends.

Growth of Concrete Barges.—Nowhere in shipping activity do we find a more immediate field of usefulness than in the construction of tugs and barges. The Emergency Fleet Corporation have designed a concrete tow barge for the Erie Canal, with a capacity of 500 tons, whose cost will be not over $20,000 as compared with a cost of $40,000 for a 575-ton steel barge. The Inland Waterway Commission is asking for bids on 21 of these barges. The Navy Department, also, has let contracts for twelve 500-ton concrete barges for harbor work, and the Quartermasters' Department of the Army is open to proposals for 22 tugboats of wood or reinforced concrete. It should be noted that a concrete barge can be built in one third the time required for building a steel barge.

A Wonderful Railway Record.—The Interborough Company announce with pardonable pride that they have carried a total number of passengers equal to twice the population of the globe, with a loss of only two lives. Railroad men will understand what this means when they remember that the express trains, running at 40 miles an hour, are being operated, in the rush hour, under a headway of between one minute and forty-eight seconds. The safety of subway travel in New York is due largely to that most efficient device, the automatic train stop. A few years ago, the SCIENTIFIC AMERICAN published several designs for automatic stops for steam railroads; but not much has been heard of this subject of late years. Has this investigation been dropped? We hope not; and we commend the subject to the earnest consideration of Mr. McAdoo and the Railway Administration.

Admiral Sims on the Submarine War.—Admiral Sims states that the area of ocean traversed by merchant shipping is so extensive that to hunt submarines with proficiency would require a vast fleet of anti-submarine craft, and that the Allies have not enough for this purpose in any one of the numerous operating areas. Although the submarine campaign will fail, it still possesses the power to do the Allies very great injury. Therefore, the anti-submarine forces should be increased with the utmost rapidity. He states that there are between 4,000 and 5,000 vessels of various types operating against the U-boat, and that, of this total, America has so far furnished only a small percentage. Attention was drawn to the unity and harmony of coöperation in our own and the Allied fleets, and it was urged that we should double our efforts to increase our representation in European waters.

Destroyer Built in Record Time.—Scarcely had the American people learned of the launching of the "Tuckahoe" at a private yard in 27 days from keel laying, than there came the announcement that the Mare Island Navy Yard, California, had launched the destroyer "Ward," one of our latest type of over 1,000 tons displacement, in 17 days after the keel was laid. What makes this performance particularly meritorious is the fact that the "Ward" was 89 per cent completed when she left the ways. The shell was riveted up, with all outboard valves, bilge keels, fenders, and propeller guards in place. The water-tight bulkheads and structure stanchions were complete, as were the boiler and engine foundations, and the deck houses and fittings. The deck was all riveted up, except where the plates were left bolted to provide for installing the boilers. The mast and topmast were in place. Of course much special preparation had been made, as is always the case in these speedy jobs, a fact that Secretary Daniels does not conceal. He tells us that the bulkheads, sections of the keel, deckhouses, bridge structure, and a section of the stem were riveted up ready for assembling in place; but granting all this, the Mare Island Yard is to be congratulated on a great performance.

Science

A "Galton Society" has been organized in New York city by a member of American men of science interested in the study of mankind. The membership is limited to 25. Dr. Charles B. Davenport, director of the Carnegie Station for Experimental Evolution, has been chosen president.

Magnetic Equipment of Amundsen.—Capt. Roald Amundsen has been fitted out by the Carnegie Institution of Washington with a complete equipment of instruments for magnetic observations and a programme of observations has been drawn up for his use during his prospective stay of several years in the arctic regions.

The Walker Grand Honorary Prize of the Boston Society of Natural History is awarded every five years "for such scientific investigation or discovery in natural history" first made known in the United States as the council of the society may consider most worthy. This year the prize takes the form of a one-thousand-dollar Liberty bond, and has been awarded to Prof. Jacques Loeb, of the Rockefeller Institute for his various published works in natural history.

A Guide to the Seeds.—To determine the species of seeds, separated from their parent plants, is usually a difficult task, but it is one of considerable importance in connection with the impurities and adulterants found in commercial seeds. Interest therefore attaches to a "seed key" to some common weeds and plants, published by E. L. Palmer in the Proceedings of the Iowa Academy of Sciences, Vol. 23. Seeds of 118 common weeds and other plants are described, and there is a brief bibliography on the subject of seed study.

The Best Fumigant for Destroying Rats on Ships.—Dr. R. H. Creel, of the Public Health Service, has made a report on the relative efficiency of fumigants for rodents on ships, as determined by subsequent intensive trapping over a period of one year. Sulfur dioxide was used on 62 vessels and hydrocyanic gas on 182 vessels. With a much shorter period of exposure, the latter resulted in the destruction of 95 per cent of the rodents, and the sulfur of only 77 per cent. Dr. Creel concludes that "sulfur fumigation is not effective for the destruction of rats on loaded vessels or in superstructures."

Testing Compasses at the Bureau of Standards.—One of the many new undertakings of the Bureau of Standards is an investigation of magnetic compasses, on behalf of the Naval Observatory, the joint Army and Navy Board on Specifications, and the Shipping Board. The Bureau proposes to develop a standard method of testing compasses and to prepare specifications for the purchase of compasses by the Government. A special form of magnetometer has been devised for the determination of magnetic moment and a rotation test for pivot friction is being developed. The Bureau expects to test several thousand compasses in the course of the present year.

"Black Alkali" in Colorado.—Dr. W. P. Headden, of the Colorado Agricultural Experiment Station, has been investigating the almost complete loss of fertility of an area of from 400,000 to 500,000 acres in the San Luis Valley of Colorado, and attributes this condition to so-called "black alkali," composed largely of sodium carbonate. This carbonate is carried in the waters of the valley, including the rivers and the artesian wells, and the practice of subirrigation has brought it to the surface by capillarity and evaporation. Dr. Headden suggests that the remedy lies in a conversion of the carbonates into sulfates by the use of a liberal amount of gypsum—about nine pounds of gypsum to one pound of black alkali—and downward washing by means of surface irrigation with furrows or by flooding.

To Systematize Scientific Publication.—The perennial problem of introducing more order and coördination into the publication of scientific papers so as to facilitate each scientist's access to the literature that he especially wishes and needs to see has been taken up anew in England, where it formed the subject of a recent conference arranged by the Faraday Society. One suggestion that appears to have been emphasized at the conference was that societies should more commonly hold joint meetings to discuss subjects of mutual interest—borderland topics—and publish the proceedings of the meetings in the transactions of the two or more societies concerned. The question of adopting uniform page-size and type to facilitate the publication of the same paper in two or more journals was also considered; a proposal that recalls Ostwald's well-known idea of a Welt-Format. There is at present a great deal of duplication of the work of abstracting for the ordinary scientific journals, as distinguished from purely abstract journals (such as *Science Abstracts*). We believe, however, that this is rather an advantage, since one abstract supplements another and serves as a check upon the personal equation which always figures largely in such work. It is understood that the Board of Scientific Societies, in Great Britain, is planning to publish a weekly journal containing announcements of papers read at scientific meetings and other current literature.

Industrial Efficiency

Acetylene Gas for Engines.—It is reported that experiments are now being made in Norway to operate automobiles with acetylene gas. No gasoline has been obtainable for many months, and practically no automobiles have been running. If the motors can be made to use acetylene gas, it can be manufactured in considerable volume from calcium carbide, which is produced in large quantities in Norway by means of water power. The gas could be carried in cylinders under high pressure, or generated from carbide on the automobile itself.

Longer Burlap Bags.—Something like 21,000,000 yards of burlap could be saved if fertilizer dealers would use 200-pound bags instead of the more common 100-pound size, according to a recent announcement of the Department of Agriculture. In this manner the supply of burlap could be materially conserved—and this at a time when the material is growing scarce because of its increased use in trench warfare, food shipments, and reduced importations.

An Electrical Dubbing Machine is being employed in a Portland, Ore., shipyard with excellent results. Indeed, it is reported that this machine saves the labor of from fourteen to twenty skilled workmen. For smoothing the surface of timbers by hand, skilled adze men are required. The electrical dubber requires but one operator. This machine is a mechanical means for dressing off the irregular and uneven surfaces of the frames on wooden vessels preparatory to planking. It employs a rotating cutterhead to which knives are fastened.

Blotters and Grinding Wheels.—Compressible washers of pulp or rubber between the grinding wheel and flanges are safety appliances if properly used, according to *Grits and Grinds*. They distribute the pressure evenly when the flanges are tightened by taking up any imperfections in wheel or flanges. Sometimes, however, these blotters are carelessly glued on by either the manufacturer or agent, distributing the glue unevenly. Glue in one spot will sometimes cause a wheel that is in perfect truth on its side to "run out." Sawdust, in which wheels are packed, sometimes works under the blotters if they are not properly glued on, producing the same results as uneven distribution of glue.

Repairing the Soldiers' Uniforms.—Hundreds of women are now being employed by the Government in the work of repairing the garments of soldiers and also in the laundries of cantonments. The former work is said by the Quartermaster General's Office to have cut down the issue of new clothing and new shoes from 30 to 40 per cent in some instances. In employing the women preference is given to the wives, sisters and mothers of men in the service. The plants where the mending is done are run in connection with forts and camps by the Camp Quartermaster. When a soldier tears or rips a garment he turns it in to his Supply Officer. In turn it is taken to the repair shop managed by the Conservation and Reclamation Officer. When in order the garment if possible is returned to the original owner. The same methods of thrift are being used in conjunction with camp laundries. By paying one dollar a month a soldier is entitled to a weekly bundle of laundry of which the number of articles is not limited. In almost all instances women operate these laundries. They also mend and repair all garments before they are laundered.

Running the Power Plant on Wood Shavings.—A power company of Poplar Bluff, Mo., is using wood shavings from a nearby wagon-spoke factory for fuel. As the factory is about 2,000 feet from the power house, it was at first considered advisable to convey the shavings to the plant by means of a pipe line equipped with blowers. It was found impossible to do this on account of the character of the shavings, which were of the long hardwood type. The shavings therefore have to be hauled to the plant by wagons and are dumped into a storage shed. A flight conveyor carries the shavings to the boiler room and drops them into conveyor pipes which lead to the furnaces. Shavings swept past the pipe openings are caught by a chute and dropped into a cage mounted on a wheelbarrow. They are then wheeled back to the storage shed at frequent intervals. In order to fire the shavings in combination with coal the furnaces, which formerly burned coal alone, had to be redesigned. It was decided, continues *Electrical World*, to extend the furnace fronts to give a Dutch oven effect. When the furnace fronts were extended it was possible for the conveyor tubes to drop the shavings directly over the middle of the fires. It has been observed that the efficiency with shavings is greater than that with coal alone, because coal cannot be thrown far enough back into the furnace to give the best results. Under the present method of operation, coal is shoveled into the furnace in conjunction with the shavings, as the supply of shavings varies with the output of the wagon spoke factory. During the recent severe winter it was impossible to obtain coal, and had it not been for the availability of the shavings the plant would have been compelled to shut down for lack of fuel.

Giving the alarm from a Paris roof

When the Hun Comes to Paris

The Huge Sirens That Warn the Population to Take Shelter

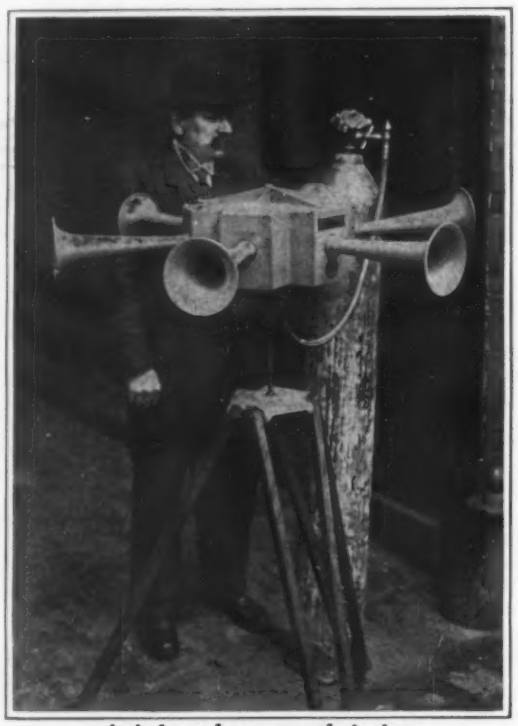
By Jacques Boyer

BY the sweetness of their song the sirens of old enticed sailors upon their reefs. The sirens of today, on the contrary, save mortals from the dangers which beset them, and render all sorts of other useful services to humanity. In bad weather they play, by land as well as by sea, the rôle of warning signals; in shops and factories they call the workers to their tasks, sound the coming of meal time, and announce the end of the daily stint. And more recently, this pacific instrument has seen its domain enlarged in the face of war, while engineers have exhausted their ingenuity to swell its voice and give it a bellicose accent.

The term "siren" does not, of course, include all machines for making a noise. By far the greater proportion of these operate by communicating to the air the vibrations of a membrane or other solid body. Among this majority are to be found practically all musical instruments, all whistles and bells—and even the human voice, which after all is merely a machine for making a noise. But the siren creates its atmospheric disturbance in a different way—by a more direct mechanical action. It produces first a powerful current of air; and then, at very brief intervals, it cuts this off and releases it again, maintaining this alternate action indefinitely. The rapid sequence of areas of compression and rarefaction which are to be found in the path of such a current, so treated, are amply sufficient to cause vibration of the ear drum, or, indeed, of the phonograph diaphragm or any other membrane which intercepts that path. The disturbance in the air which does this is, so far as psychological or mechanical effect is concerned, not to be distinguished from a true sound wave, produced by more conservative means; so the siren takes its place as a sound-creating machine.

The idea of producing sensations of sound in this manner dates back to Baron Cagniard de la Tour, who in 1819 constructed a machine along these lines for the purpose of studying the vibration rates of sound. He gave his invention the name of siren to suggest its power of causing sound phenomena in water as well as in the air. The Baron's apparatus differed in no essential principle from the present day instruments; but the good physicist, who had no way of anticipating the application of steam or compressed air to his machine, was content to make his siren sing by means of a bellows. He placed a fixed disk and a rotating disk upon a common shaft, cutting in each disk a series of diagonal holes forming concentric circles. The bellows delivered its current of air at an angle against the surface of the rotating disk; and when the holes in the two disks matched up the current passed the ensemble, to be cut off again when the holes in the one disk moved around into conjunection with a blank section of the lower one. The sound of the siren, deep at the beginning, strikes a higher and even higher pitch as the speed of rotation increases, until finally it becomes fixed when the frictional resistance against rotation comes into equilibrium with the applied force, so that rotation proceeds at a constant rate.

Today, sirens of precisely this type are still in wide use, but with steam or compressed air for the sound-producing medium, and electric motors for the rotation of the disk. Ordinarily compressed air for the operation of the siren is stored at a pressure of 15 atmospheres in reservoirs of some five or six cubic yards capacity; then by means of reduction valves the working pressure is brought down to two or three atmospheres. Such sirens are especially common in lighthouse use. In France the marine siren gives a simple note, and consumes about 400 liters of air per second; musical regulation is obtained by means of four adjustable blocks attached to the shaft of the rotating cylinder. These, by pressure against a circular track, limit the velocity of rotation by increasing the friction. The British Admiralty, on the other hand, prefers a siren of two notes, the one high and the other low. This of course is attained by combining two sets of disks, with different rotation speeds. To cover a wide arc of the horizon, it is customary to employ two



A six-horned compressed-air siren

sirens, enclosed in boxes or drums, with horns to permit the sound to escape in a given direction only; these horns can be fixed at any desired angle with one another to give the appropriate angular range.

Much latitude of design is naturally to be found when we come to attach horns to the siren, as just suggested. The machine may be enclosed in a box, in fact some such arrangement is essential; and we may have one or several horns leading from the same box, with a wide variety of internal passages to bring the current to the horns, and of mazes intended to augment the force of the current and hence the pitch of the note.

An interesting variant of the double-disk idea is the use of a single disk with a tube. The current is delivered through the tube, which is held firmly against the surface of the disk by means of a powerful spring. As more and more air is forced into the tube, however, the air pressure therein rises until it passes the ability of the spring to hold against it. The end of the tube then jumps back from the face of the disk, and air escapes. As soon as the pressure, thus given vent, falls below the push of the spring, the tube returns to its former position and passage of the current is cut off. This pulsation back and forth of the tube of course continues at a rapid rate once it has been set up. The apparatus is so mounted that the range of the tube-end, in its oscillations into and out of contact with the plate, is but a few hundredths of a centimeter, so it never fails to come back as it should. In this machine, the pitch is controlled by varying the dimensions of the metal channel leading from the drum inside which the action takes place to the horn; this will obviously alter the frequency with which the areas of high and low pressure reach the open air.

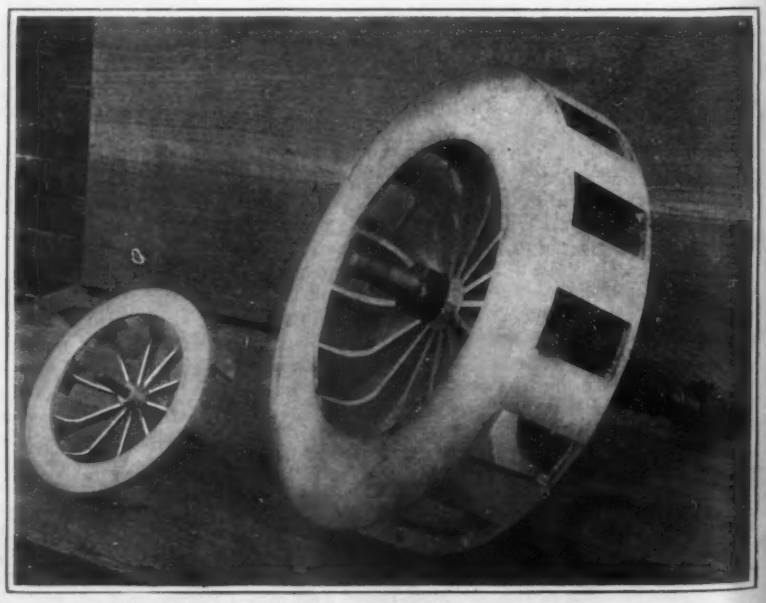
The latest thing in sirens is rather more powerful than any of these disk machines. The current of compressed air is led to the center of a turbine, where it escapes at uniform speed and uniform pressure, without interruption. The casing of the turbine is provided with a series of "windows" as the French rather prettily call them; while its internal construction reveals a number of passages leading to the periphery. The rotation of the turbine of course throws the air violently outward within the casing, by virtue of centrifugal force; but it can only have vent when the passages, in the course of rotation, come opposite the windows in the casing. It will be seen that here we have a vastly more powerful apparatus than those described above. There is hardly any limit to the strength of the current, or the frequency with which it can be cut off and restored. Transmission of sound may be in all directions, by means of a series of horns on all sides of the drum containing the apparatus, or it may be in a single direction alone by closing all exits in the drum with one exception, and applying a super-horn at that exit.

The Paris sirens, of this type, weigh *in toto* 800 kilograms (1,760 pounds). They are operated by an aluminum turbine half a yard in diameter, with horns two yards long and half a yard across at the ends. Their range over open country would be some five or six miles; but in Paris the city noises make it impossible to hear them further away than a mile or so. At Dunkirk, where the single horn is used, the siren weighs about a ton. It is mounted on a rotating carriage, so that it can give its alarm in all directions; and the horn is three yards long and nearly five feet across at the mouth. The turbine is half a yard in diameter, and operated by a 10-horse-power motor. The range exceeds that obtained by the Paris apparatus, with its greater diffusion.

Before long, 26 enormous sirens of the diffusion type will disport themselves upon the various high spots of Paris, and their powerful voices will be heard in all corners of the City of Light when the Huns come with their bombs. At the moment of writing, only a few of these machines have been put in place.

In the smaller cities the power turbine is frequently replaced by a small hand-operated machine, as shown in one of our illustrations. These little sirens are likewise used in factories, arsenals, camps, etc. They all fall back upon the principles set forth in describing their big brothers, but their voices carry over a range of no more than five or six hundred yards.

The hand-operated siren, for small villages and factories



The turbines used in the small and large French sirens

The circular cultivator doing its rounds

The Washburn farm, showing the circular furrows

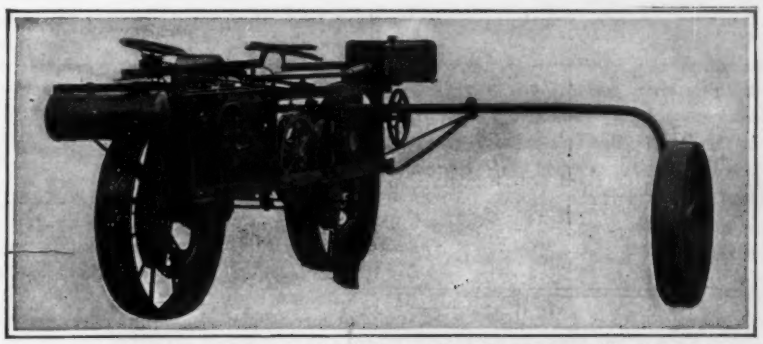
The Circular Farm

By Robert H. Moulton

A MACHINE which automatically plows, sows, cultivates and reaps, with only perfunctory attention at the hands of man, has been invented by Mr. Herbert Washburn, of Magnolia, N. J., and tried out by him with great success on a 10-acre farm. This machine consists of a four- or eight-horse-power gasoline engine adapted to any ordinary agricultural implement, as well as delicate guiding apparatus connected by a broom wire to a drum mounted on a steel post in the center of the field. As the tractor moves, the wire winds about the drum, shortening the radius just enough to guide the working implement into a gently in-winding spiral. The circumference of the drum is thus the width of the furrow or row or swath. All the farmer has to do is to connect the wire and crank the engine, which will then work its way around and around without attention, till the small circles near the central post are reached and the field is done. There is no wobbling away from the rows or any too close approach to them. The distance is kept exactly.

Last summer the inventor worked 10 acres at a time, which area he considers should be standard among farmers using his motor. A field of this size requires a cable 371 feet long, although longer cables may be used if necessary. Almost any farm machine may be drawn by this motor through the simple expedient of giving it a stub tongue. In addition to the plow and cultivator, the disk, potato planter, plant setter, seed drill, spraying machine, etc., may be used. While the work of some of these naturally involves the attention of a man, in the majority of cases the laborer is excused.

It would seem that this device is the appropriate accompaniment to the tractor, that it may eventually, if generally adopted, mean the emancipation of the farmer from farm drudgery. Another advantage of the machine is that it can be used to cultivate fields at night, since no light is required to guide it.



A close view of the circular farm motor, without the guide wire

The drum about which the guide wire winds as the circular motor goes around it

Watering the Garden by Long-Distance Telephone

NO matter where he may happen to be during his vacation, whether a few miles or a few hundred miles distant from his home in New York city, Eberhard Schneider never fails to water his roof garden back in the metropolis. His second-floor garden contains over a hundred different flowers and vegetables; and for years his recreation has been largely in caring for these himself. Every evening, unless it rains, Mr. Schneider waters his garden, either at first hand or by long-distance telephone. In this manner he prevents his treasured plants from being scorched.

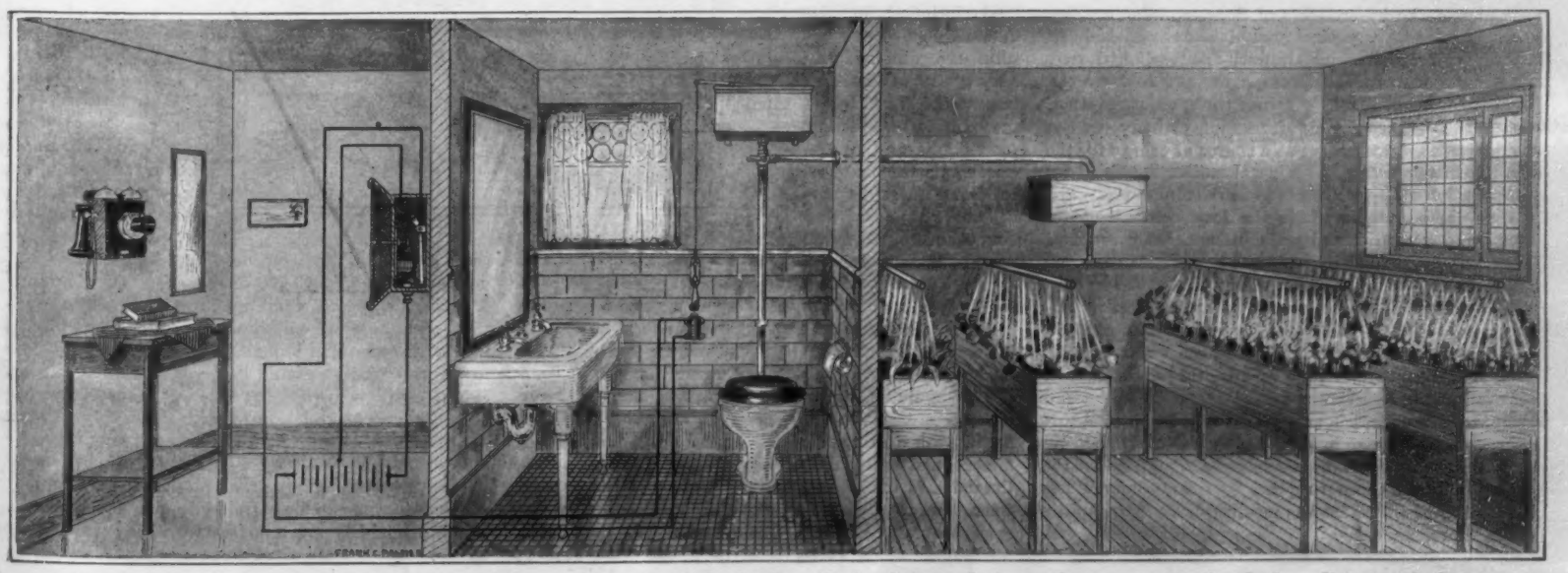
But how does he water the garden by long-distance telephone? Therein is the story which is told by the accompanying drawing.

It will be noted that Mr. Schneider makes use of the usual toilet system for watering his garden, by means of a two-way stop-cock in the pipe leading down to the

(Concluded on page 115)

Partial view of the telephone-operated roof garden

Sunshine-reflecting mirror of the city garden



Arrangement of apparatus, plumbing and wiring for watering a city garden by the pull of a chain or, during one's summer vacation, by long-distance telephone

What Shall We Do With Wheat Bran?

Is Its Use for Human Food the Most Efficient Utilization of Its Mineral Constituents?

By A. D. Holmes

THE larger part of the wheat used in this country for human food is consumed in the form of wheat flours, of which there are three principal types: White or patent flour representing 72 per cent of the wheat kernel, entire or whole-wheat flour representing about 85 per cent of the wheat kernel, and graham flour which represents 100 per cent of the wheat kernel. Of these the white flour is the most extensively used, constituting about 98 per cent of the total wheat milling. The extent to which wheat flour is used in the American dietary is perhaps more clearly stated by saying that, on an average, approximately one-fifth of the total protein consumed and about one-fourth of the total energy of the diet is derived from wheat flour. It is well-known to students of nutrition that people of small incomes derive a larger portion of their nutriment from bread; and in times of stress or privation all people, regardless of country or race, tend to make their diet largely of bread, providing a sufficient supply of cereals is available.

AN accurate conclusion as to what portion of the wheat bran should be used for human food in order to secure most efficient utilization of the wheat can be had only after many factors have been given careful consideration. Among these are the chemical composition and the digestibility of the bran, the possibility of replacing it with other food products, the economic and food value of products proposed for such replacement, the value of the bran for stock food and fertilizing purposes.

All of the countries now engaged in the World War have, of necessity, been obliged to give very careful and detailed consideration to the rationing of the civilian as well as the military population. From time to time the question has arisen as to whether the available wheat could not be more efficiently utilized by manufacturing flours containing a high percentage of the wheat kernel. That all are not agreed as to how much of the wheat kernel can be best utilized by the human body, is shown by the fact that, while Germany, France, England, Italy, and the United States have raised their standards for milling, no two of the countries are so milling their wheat that they secure the same percentage of extraction. The fact that France has seen fit to reduce the standard formerly required for the milling of wheat would seem to indicate that those in charge of food regulations in France are not convinced that the best results are to be accomplished by utilizing so high a percentage of the wheat kernel for human food.

An accurate conclusion as to what portion of the wheat kernel should be used for human food and what portion should be used as stock food in order to secure the most efficient utilization of wheat for food purposes can be had only after many factors have been given very careful and thorough consideration. The chemical composition of wheat bran, the digestibility of the food constituents contained in the bran, the possibility of replacing the wheat bran with other cereal and legume flours, the food value of such products as compared with that of the bran which they replace, the value of bran for stock food, its value for fertilizing purposes, must be given proper weight, together with other factors which need not be enumerated here. Fortunately data are at hand regarding many of the factors which have received the attention of investigators either directly or indirectly concerned with a study of the nutritive value of wheat and its products.

The chemical composition of wheat flours of different types and of the by-products of flour manufacture has been determined. Chemical analysis shows conclusively that wheat bran contains protein, fat, carbohydrates, and mineral matter, all of which are required by the body in order that it may continue to function properly. Protein is necessary for the formation of body tissues; fat and carbohydrates serve as a source of energy for the activities of the body; and mineral matter is needed for the formation of bones and body tissues and fluids. The data on the extent to which the food constituents of wheat bran are utilized by the human body are not, perhaps, quite as definite as in the case of the composition of bran. A large number of experiments have been made in this country and abroad to determine the relative digestibility of white and graham flours; that is, flours which contain no bran and those which contain all of the bran normally present in the wheat kernel. When all of the experiments of both the American and European investigators are considered as a whole, it appears that the protein and carbohydrate supplied by graham flour are not as completely digested by the human body as those supplied by white flour. The digestibility of wheat fat has received little attention by investigators, probably because it is present in such small amounts as to be a secondary consideration.

Wheat substitutes, which may be mixed with wheat flour and satisfactorily replace the bran which is removed in the manufacture of white flour, are well known. The data regarding the chemical composition and digestibility of these wheat substitutes are, in many instances, quite complete; and a consideration of these data is sufficient to convince a student of nutrition that some of the mixtures of white flour with other cereal or legume flours are superior in food value to the graham flour that contains all portions of the normal wheat kernel.

Data regarding the food value of the by-products of white flour manufacture for animals or poultry are less complete. It is, however, quite generally accepted that an animal is a wasteful converter of food; even the pig, which is the most economical, returns in the form of meat only about fifteen per cent of the energy supplied in its food. On the other hand, digestion experiments with humans and animals seem to show that the by-products of white flour manufacture are more completely digested by the animal than by the human body. Furthermore, chemical analyses and many carefully controlled feeding experiments with laboratory animals show quite conclusively that the proteins of wheat are inferior as a source of tissue-forming material to the animal proteins contained in meat, milk, eggs and cheese. Chemically speaking, the wheat proteins do not supply in adequate amounts all of the amino acids necessary for the formation of tissue, while the proteins of milk, meat, eggs and cheese are satisfactory in this respect.

From this very brief reference to some of the factors which should be considered in connection with the most economical milling of wheat for human food, it is quite apparent that this question can not be intelligently solved by giving attention to only one or two factors. It is the primary purpose of this article to call attention to a factor which seems to merit more consideration than is often given to it, namely the fertilizing value of the mineral constituents of the by-products of white flour manufacture. Chemical analysis shows that white flour contains only about one-fifth of the total quantity of mineral constituents present in the wheat kernel. These minerals are necessary for proper nutrition of the body; and it appears perfectly logical to conclude that one obtains more of them from bran than from an equivalent weight of white flour. However, the mere presence of a mineral or other constituent in a given food is not sufficient, for obviously in order to possess nutritive value the constituent must be available for body uses—on entering the human system, it must be digested.

Assuming for the moment that the mineral constituents of wheat bran are assimilated or digested as completely as the mineral constituents of any other food included in the human diet, what results are obtained by adding the mineral-rich bran to the diet? In the first place, if the present food habits of the American people may be considered a safe guide, it would appear that the ordinary American mixed diet, containing fairly liberal amounts of meat and milk, furnishes sufficient ash or mineral matter to meet the body's requirements. In such a case the excess mineral constituents merely place an added burden on the excretory organs of the body, and are eventually for all practical purposes lost; for under the modern conditions of living, human excreta serves only to polute the stream into which the sewage of any city or village flows. Considering one individual only the loss of mineral matter in this way is negligible; but considering the value of the mineral matter involved by the general consumption of wheat bran the proposition becomes of considerable economic importance. Of the many mineral elements which occur in wheat bran, such as iron, calcium, megnesium, potassium, and phosphorus, only the last two will be considered here from the standpoint of their value as fertilizers.

The results of a large number of experiments with growing plants seem to show quite conclusively that potassium and phosphorus are essential for satisfactory plant growth. When considered for fertilizing purposes, the oxides of these elements are quite commonly referred to as potash and phosphoric acid. Previous to the outbreak of the present war this country was importing from Germany something like a million tons of potash, all of which was used for fertilizer purposes. When this source of supply was cut off, the potash situation became serious indeed, and in some localities farmers attempted to raise crops without adding potash to the soil. The government immediately took steps to find a new source of supply. The Geological Survey made a survey of all potassium-bearing rocks which seemed to offer commercial possibilities. The Department of Agriculture studied the recovery of potassium from cement manufacturing plants and the commercial growing of the Pacific coast kelps, seaweeds which extract potassium from the sea water. While these and other studies are happily producing gratifying results, the present supply of potassium is quite inadequate to meet the demands.

The case of a supply of phosphorus is somewhat different in that there are large deposits of phosphate rock in this country. Formerly the manufacturers of commercial fertilizers felt that even though the supply of Chile saltpetre, from which the nitrogen for fertilizer purposes was largely obtained, might fail and the shipments of potash from Germany might be temporarily shut off, an adequate supply of phosphoric acid would be always available since it is only necessary to add sulfuric acid to phosphate rock to render the phosphorus available for plant food. However, the military needs are such that only relatively little sulfuric can be spared to "cut" phosphate rock and so the situation regarding this fertilizing material has become serious, even in spite of the fact that over two hundred patents have been granted on methods of rendering the phosphorus in phosphate rock available for plant food.

The amount of potassium and phosphorus in wheat is likely to vary somewhat with the season and locality in which wheat is grown; but it perhaps may be assumed that wheat contains two per cent of ash. A bushel of wheat which weighs 60 pounds would on this basis contain 1.2 pounds of mineral matter from which can be obtained .36 of a pound of potash (potassium oxide), and .65 of a pound of phosphoric acid (phosphorous pentoxide). The 500,000,000 bushels of wheat used annually in this country for flour-making would produce approximately 105,000 tons of potash worth at present prices something over $47,000,000, and approximately 162,500 tons of phosphoric acid worth about $23,000,000. —a total of $70,000,000. Since white flour contains only one-fifth of the total mineral matter present in the wheat kernel, the fertilizing value of the potash and phosphoric acid present in the by-products of white flour manufacture would be approximately $56,000,000 annually if these by-products were spread directly upon the land. When used as stock feed, a portion of the mineral elements is retained by the animal body; but it is believed that, of the total amount of mineral constituents present in wheat, at least one-half is eventually used for fertilizer purposes if the mill products are fed to animals and the resulting fertilizer is carefully returned to the land. The value of the potash and phosphoric acid from the wheat bran thus returned to the land would be at present prices $30,000,000 or more.

IT is a military necessity that each acre produce the maximum of human food. The situation regarding a supply of potash and phosphoric acid for fertilizer is acute. It would seem, then, that in attempting to decide what milling standard should be adopted for the most efficient utilization of wheat as human food, attention should be given the fertilizing value of the mineral constituents of the bran.

Under the present conditions it is a military necessity that each acre of cultivated land shall produce the maximum amount of human food. It is imperative that sufficient attention should be given to the maintenance of soil fertility so that the production of future crops is assured. The situation regarding a supply of potash and phosphoric acid, essential for fertilizer purposes, is very acute. It would seem, then, that in attempting to decide what milling standard should be adopted to utilize wheat most efficiently for human food, some attention should be given to the fertilizing value of the mineral constituents of wheat bran.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Warfare by Analogy

To the Editor of THE SCIENTIFIC AMERICAN:

Your article, "From the Trenches to Open Warfare" in the July 27th number of THE SCIENTIFIC AMERICAN magazine, with its discussion and analysis of Von Hutier's system or method of piercing an enemy front, is suggestive of the possibilities in the use of analogy.

Just as Herbert Spencer will perhaps seek aid in explaining a social phenomenon by reference to an analogous biological phenomenon, for instance, so might we seek assistance in endeavoring to pierce an enemy front by studying accepted and successful methods of piercing armor plate by steel projectiles or bullets.

Thus, if we liken an enemy trench defence system to a steel armor plate to be pierced our first problem will be to obtain knowledge of its composition and its thickness; in other words it will be necessary to ascertain the make-up of the trench system, its proportion of concrete, steel, dugouts, wire, guns, human material, etc., and the depth of the system.

Our second problem will be to devise a bullet of such shape, diameter, weight, character of nose, cap and slug which, with a necessary striking velocity, will pierce this armor. According to some authorities the "boat" shape ensures better penetration. Our diameter would be width of frontal attack; weight would equal number of troops used plus their equipment; the "nose" and "cap" would be represented by mobile armored cars to open the way for the "slug" composed of tanks and heavier mobile artillery accompanying the fighting body of troops; whereas everything depends on "striking velocity."

Our third problem is to make the very utmost use of the "slug." This is the most important problem of all. If we merely pierce the armor without killing—or at least putting "out of business"—the sniper behind the armor we have accomplished virtually nothing. By merely piercing a trench system we may gain territory by compulsory retirement on the part of our foe. If there is plenty of room back of him the retirement may give us no gain of importance. Our "slug" must be large enough, heavy enough and carry sufficient residual momentum to penetrate and pierce a vital spot back of the armor plate, and thereby completely cripple our enemy or put him "out of business." Military experts in their comments speak of "rolling up" an enemy line as a final objective, but to my way of thinking this would be merely an endeavor to rip the armor covering from our enemy, whereas the enemy *heart* is what we want to get after, and the enemy reserves "bunched" some miles back of the trench system constitute that heart. In other words the enemy reserves should be our target—the sniper referred to above.

All of this sounds like a big order especially if we think of reserves massed 60 miles behind the front lines or of scattered reserves not concentrated at one spot, but the fact is that the final decision rests with the reserves, therefore if they are not so placed by the enemy to make them a good target we will have a fourth problem on our hands involving a compulsory shifting of his reserves by him to a spot of our choice. This may require two "bullets"; long range guns using gas shells or other means.

The Von Hutier "waves" of assault would suggest the boring process of a bullet during penetration, and would only affect the "nose" and "cap" of the bullet both of which would be more or less sacrificed according to the composition and thickness of the armor plate or trench system.

HENRY A. FROOM.

Clinton, Mass.

Why Is a Dog?

To the Editor of the SCIENTIFIC AMERICAN:

On one of the back pages of your issue for May 4th, you have an article that is very pertinent at this season. The only criticism is that it is three inches instead of three columns long. I refer to "A Pet Sheep Instead of a Dog."

Dear old tailwaging Towser may be a congenial companion but the chances are that he is a liability instead of an asset, and in a sheep country his environment tends to make him a criminal. In this community, which was formerly noted for its sheep, sheep raising is nearly a lost art and instead the production and distribution of high grade cur dogs is followed. Of all the dogs owned and disowned in this locality I know of but one, and that one is owned by a stock dealer, that is worth his salt; and they range in size and uselessness from the little girl's toy poodle to the gigantic base-voiced "night watching dog," owned by a member of our local colored colony.

Where it is a choice between the comfort and well being of our forces at home and abroad, and some hundred thousands of useless quadrupeds, sentiment should have but small place. Some ninety-nine per cent of the unnumbered cats might also be very easily spared at this time. *Farm and Fireside* has been very active along this line for several years. Can't you coöperate with them to the nation's advantage?

E. P. BRAINERD.

Medina, O.

Automatic Train Operation

To the Editor of the SCIENTIFIC AMERICAN:

If the war lasts a number of years longer, and the male employees of the electric railroads are drained for war purposes, railroads will have to resort to female motormen in operation of surface, subway and elevated roads. Railway managers will hesitate to place a woman on the front end of a heavy elevated or subway train.

The writer believes it a possibility to operate subway and elevated trains automatically without the aid of an operator. The present block system can easily be adjusted to regulate the speed and distance between trains and stopped automatically when approaching a certain distance of a forward train. In the same manner a train can be stopped at a station by station controls. Trains can also start automatically at stations when the circuit is formed by the pneumatic control of doors which releases the station control, starts the train and speed is again governed by the improved block system.

Owing to lack of time this article is written very briefly and lacking details, but will be pleased to furnish further information on request.

You are permitted to use this article for publication in SCIENTIFIC AMERICAN as you see fit.

DENNIS J. GRILLS.

Brooklyn.

The Castor Bean

To the Editor of the SCIENTIFIC AMERICAN:

Your correspondent in your issue of May 25th writes: "After the oil is extracted there remain vast quantities of pulp or cake apparently of no value whatever." The residual cake as it comes from the mills in southern India has a nitrogen content of from 5 to 7 per cent, and there is also a small amount of potash. Castor cake is eagerly bought for use in manuring tea, rubber, and cocoanut plantations in southern India and in Ceylon. The present writer speaks from a long personal experience in Ceylon. Ground-nut cake with a nitrogen content of 6 to 8 per cent is also largely used for the same purposes.

G. R. MARNOCH.

Lethbridge, Alberta, Canada.

Sawed-Off Shot Gun for Airplanes

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading the various articles in your paper in regard to the use of sawed-off shot guns by our troops in France, and I have been wondering if it is not possible to design a light cannon along the same lines for the use of airplanes. This seems feasible, as we read of French "75's" now being mounted on airplanes.

For instance, would it not be a good idea to mount a very light smooth-bore gun which would carry a 20-pound load of ounce bullets? This would be 320 missiles, which could be made to cover a space of 20 feet by 20 feet at a distance of say 300 yards, or the average distance that most aerial fighting is done. This would be one ball for every square foot and a fraction, which, considering the balls would be much heavier than those out of a machine gun, should give good results. At closer range, there would be two or more balls per square foot of space. With the target and the platform on which a machine gun is mounted, both moving at a high rate of speed, it can only be a chance shot that takes effect, out of a single-shot gun, while with a gun like the one above described, there are much greater probabilities of hitting the target. This gun not being made to shoot a long distance could be made exceedingly light, and use ordinary shot-gun powder.

A gun like this might also be used to good effect on land, in stopping the rushes of the enemy. I venture the assertion that there would not be 80 per cent of the wounded get back into the trenches after having been hit by one of those ounce (round) bullets. I note the Germans have a gun which they take into the front trenches.

JOHN ALGEO.

Alhambra, Cal.

Protected Merchant Ships

To the Editor of the SCIENTIFIC AMERICAN:

I have much appreciated the article "A ship within a ship" in No. 8 of this year's SCIENTIFIC AMERICAN, for the clear and accurate way in which it has been exposed, not less than for its artistic illustrations.

As the importance of the subject has begun to be seriously considered in the naval technical circles, I think it may be good to inform you that some very substantial improvements have been made in the type of cargo-boats with submarine protection, that you quoted.

I must tell you first that some practical experiments of explosions made against models representing the type of ship, which I proposed in the *Rivista Marittima* (February-March, 1917), have fully confirmed what I had foreseen. Moreover they allow me to deduce that for a good protection, a lesser strength, and therefore lesser weight of the hull, would be sufficient: Consequently with 10,300 tons displacement it would be possible to obtain more than 6,300 tons deadweight.

Following a certain line of thought and through the experience acquired from a great many practical experiments, I studied another type of protection which offers not a few advantages in comparison with the former types, especially because it guarantees the immunity of the principal hold from torpedoes, and the damaged part can be repaired without use of dry-dock.

Repeated trials gave most satisfactory results.

I hope to be able before long to expose interesting notes on this argument, whose delicate character still restrains me from offering them to the public.

I can only say, now, that the latter type of protection, applied to a design of a new cargo-boat (with a ratio of deadweight to displacement nearly normal) and submitted by the Secretary of the Navy to a Committee of the highest of our professional and naval authorities, has recently received a unanimous approval, with the decision of building this type of *transport of war* as soon as possible. On this way Italy is proceeding.

In your article, the necessity for Italy to resolve the important problem of the safety of marine transports has been rightly set forth. The surety of getting provisions by sea is one of the first elements for our utmost resistance until victory.

But Italy needs help from American shipyards to realize in adequate proportion such a program, considering the extra shortage of domestic steel, and the great difficulty in obtaining structural materials abroad. This help has just now been officially of your government; it would also strengthen the ties already existing between our countries through work and thought.

I hope that your esteemed newspaper, being given occasion, will still use its competent influence so that it may be possible to arrive at a rapid conclusion. So much more that the new protected ships, of very simple and rapid construction, will be of great advantage *to all the Allies*.

Let us remember that the enemy is not yet at the end of his tether, and that with the prolonging of the war the submarine struggle might have a further and notable development.

ING. UMBERTO PUGLIESE,
Major of the Royal Corps of Naval Architects,
Ministero della Marina.

Rome, 21 May, 1918.

A Salvage Suggestion

To the Editor of the SCIENTIFIC AMERICAN:

I have been a subscriber for and a reader of THE SCIENTIFIC AMERICAN for many years. When reading the article in the issue of July 21st, "The salvage of deeply sunken ships" the thought occurred to me that there might be a possibility of using especially constructed submarines for the raising of sunken ships—that such a submarine could have the lifting capacity and two of them, with their own power, could locate themselves on either side of the ship at the bottom of the ocean—that it would be no more difficult to place the wire cable under the sunken ship from the submarine than it is in the way that it is now done and that when the sunken boat was properly slung between the cables that the submarines could lift it to the top of the water. If the submarines were a little higher than the boat they would hold the sunken vessel as in a swing. Thus the principle of the submarine might be used for raising vessels which other submarines had been the means of sinking.

My suggestion may show of itself that I have no practical knowedge of raising sunken ships, but the human mind is so constructed that often times a suggestion which does not promise success may lead to other suggestions which do, and I, therefore, make the suggestion with the hope that if it in itself is not worthy of consideration it may lead to other suggestions which are.

If you deem this suggestion worthy of being printed in your paper please do not mention my name. If it is not worthy of it pardon my interruption and consign it to the waste basket.

San Francisco. M. D.

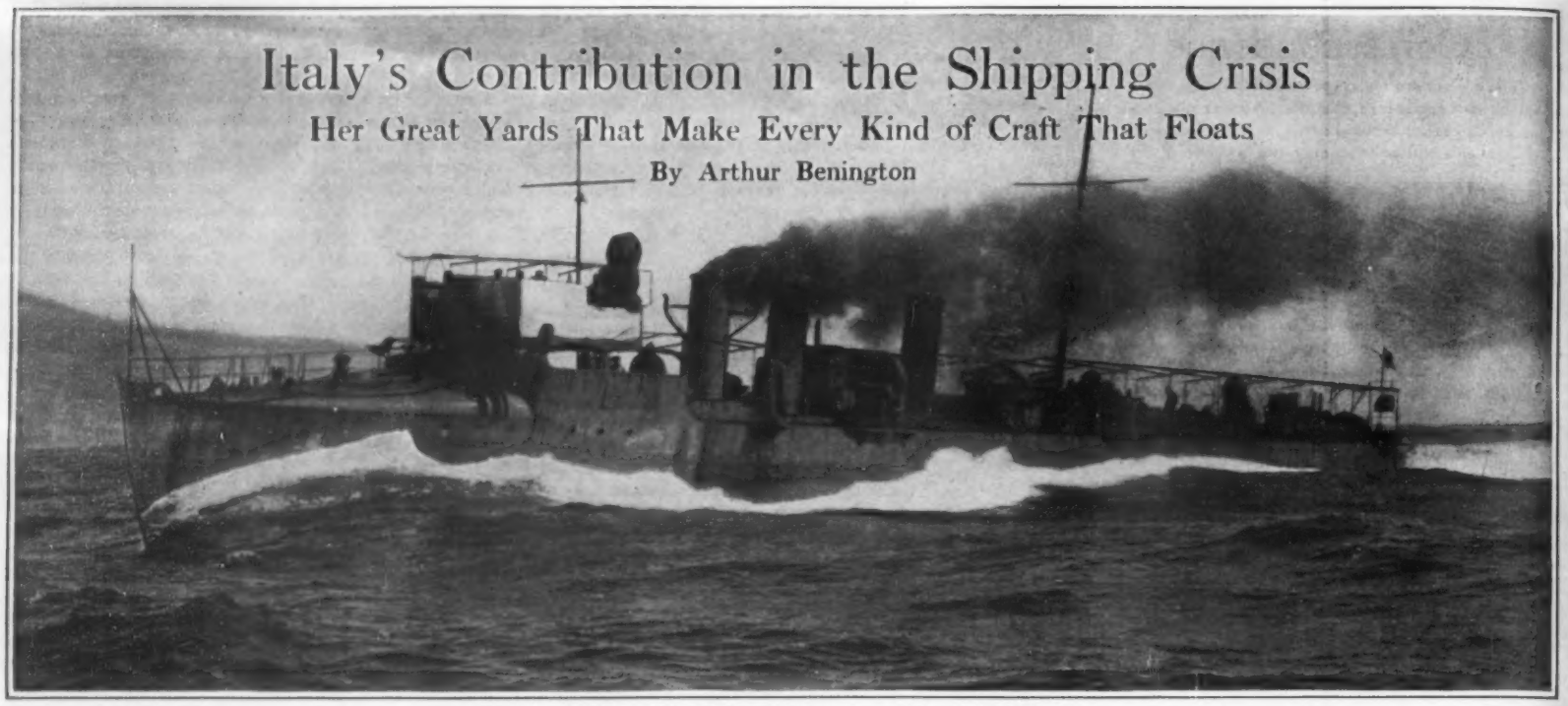
Foreign Food and Drug Laws

THE U. S. Bureau of Chemistry, in Washington, announces that it has been collecting for some years the laws, regulations and standards in force in foreign countries in regard to foods and drugs. The collection of information has been kept up to date as well as possible during the war, and the Bureau is prepared to answer questions from persons interested in such matters.

Italy's Contribution in the Shipping Crisis

Her Great Yards That Make Every Kind of Craft That Floats

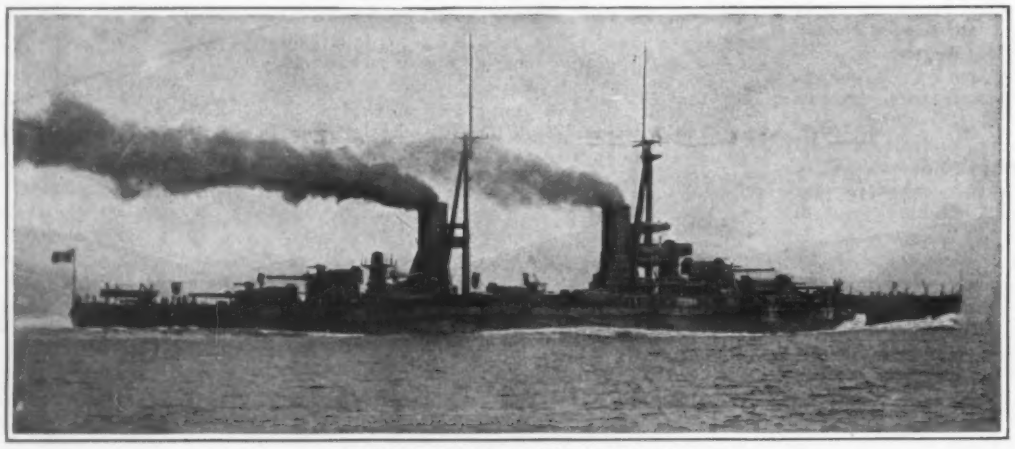
By Arthur Benington



Torpedo chaser built at the Sestri Ponente yards for the Italian navy

ENGINEERING in all its departments has probably made greater progress in Italy since the war began than in any other nation in the world. An agricultural country, without coal mines and with almost no iron, it had comparatively few industrial establishments until it was compelled by the exigencies of war to begin producing munitions and warships on a grand scale. Since then its development has been really phenomenal.

The largest factory in Italy was that of Giovanni Ansaldo & Co., of Genoa, founded by Cavour under the direction of the distinguished engineer, Giovanni Ansaldo, in 1853 and reorganized about thirty years later by the Commendatore Ferdinando Maria Perrone. This establishment had built many great battleships for Italy, Argentina, Japan and other countries; it had been making cannon, rifles, airships, locomotives, torpedo-boats, submarines, and engines of all types. When Italy entered the war the Ansaldo Company ceased all private work and devoted its entire resources to the Italian Government. Since then it has become one of the very greatest engineering concerns in the world.



An Italian battleship built by the Ansaldos

One of the company's first war enterprises was to buy out an Italian steamship company whose stock was owned principally by the Hamburg-American Line and to consolidate it with its own Societa Nazionale di Navigazione, thus making a purely Italian steamship company, with a capital of 150,000,000 lire (about $30,000,000). It also acquired control of the Fiat San Giorgio, and the Cantieri Savoia, two great ship-building companies, and began a program of building freight steamers for its own private use. These are of a standardized type, 8,100 tons burden, operated some by geared turbines and some by Diesel engines; and it was planned to launch one a month. Four of these steamers are already in commission; 22 are now in course of construction, and the program calls for the completion of 48 altogether. Besides these, the company has been building every sort of vessel for the Italian Navy, from battleships to submarines and "chasers."

It opened an office in New York, rented a pier at Philadelphia and sent a staff of experts to America to buy the material for this fleet. By the time this article appears, the money spent in America within little more than a year will amount to considerably over $35,000,000.

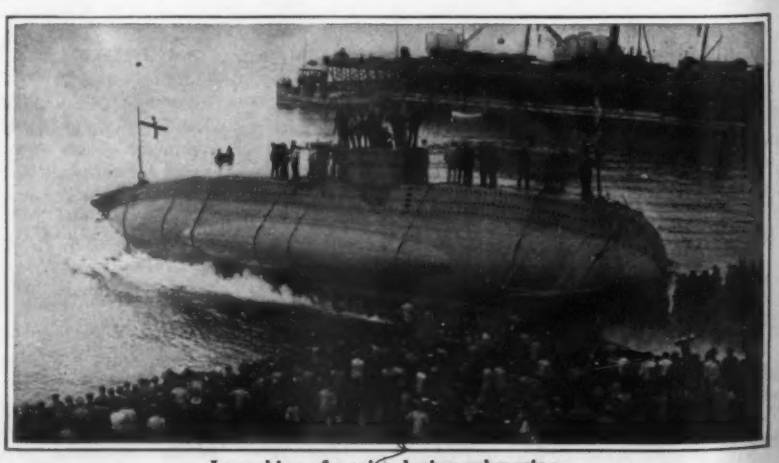
Then it sent mining experts to explore the historic iron mines at Cogne in the Val d'Aosta, whence the ancient Romans obtained their iron, but which had been abandoned for many centuries. Their report was so satisfactory that the company acquired the property and built a railroad and a huge aqueduct to link it up with lines of transportation; and it expects within a few weeks to begin hauling iron ore to its plant at Genoa.

How vast this plant has now become may be gathered from the fact that more than 60,000 operatives of both sexes are employed therein. The directors boast that it is the only concern in the world that can turn out a battleship with steam up, fully armed, stored with ammunition and torpedoes, and ready to go into action, without buying anything but coal and iron ore, every smallest detail of the work being done in its own plant. And this boast is as true of a battery of siege guns, a submarine, an airplane or a locomotive. The company even has its own bank, the Banca Italiana di Sconto, with a capital of 115,000,000 lire (about $23,000,000) of which Senator Guglielmo Marconi is president.

Coal at $150 a ton, to which price it rose in Italy over a year ago—it is now about $200 a ton—was of course prohibitive for such a plant as that of the Ansaldo Company. Therefore, it at once electrified the entire works, making an arrangement with the Societa Idroelettrica Riviera Occidentale for electric power from the latter's hydro-electric plant at Ventimiglia. This concern, commonly known as the Negri Company, after the engineer who is at its head, has one of the great water powers of the Riviera and uses it for making electricity, which is transmitted by wire over the mountains and valleys that lie between Ventimiglia and Genoa, a distance of about 100 miles. Thus the Ansaldo Company does without coal, except what it must have for its open-hearth furnaces, and for the bunkers of its fleet of steamers. As soon as its new motor-run vessels begin to perform this trans-Atlantic service it will need little more bunker coal.

The headquarters of the Ansaldo Company are at Genoa and its many establishments are scattered along the nearby coast for many miles. At Sampierdarena are the mechanical shops, the locomotive building works, artillery works, munitions works, and factories for building explosion and internal combustion motors; at Cornigliano Ligure are the steel foundry, electro-technical plant, armor-plate foundry, metallurgic laboratory, bronze

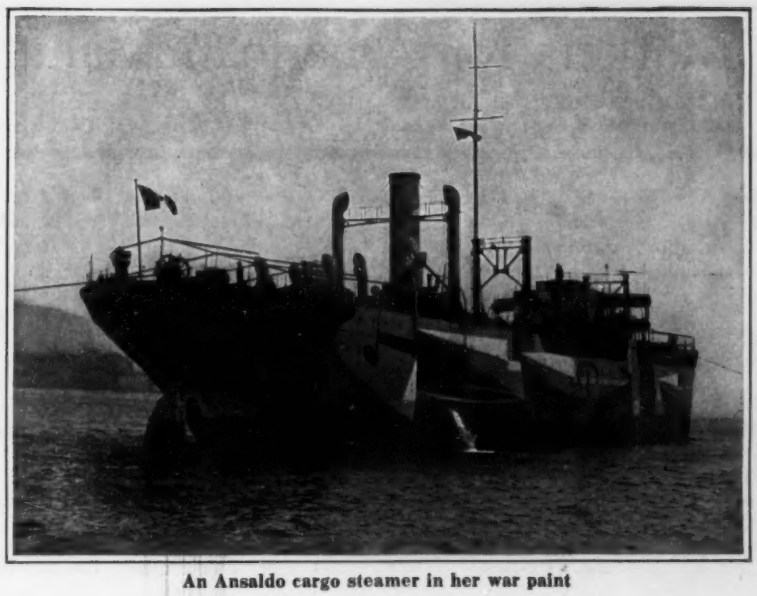
A coast-patrol torpedo boat taking the water



Launching of a mine-laying submarine

foundry, cartridge works, shipyards of the Cantieri Savoia and the tube-works; at Borzoli is the airplane factory; at Sestri Ponente the naval shipyards and the shell factory; at Pegli the pig iron foundry; at Stazzano the establishment for the fabrication of refractory bricks; the Molo Giano in the harbor of Genoa is devoted to fitting out vessels after they have been launched; the iron mines are at Cogne in the Val d'Aosta, and at Aosta are the electro-metallurgical laboratories.

The main line of railroad between Nice and Genoa passes through arches and tunnels underneath the ways on which the battleships and merchant vessels are being built in the several yards of the Ansaldo Company. These are probably the only shipyards in the world where the launch must be made directly into the sea. Fortunately the mountains rise steeply to the north of the city and thus shelter the water from northern storms; but the Mediterranean is not always so calm as it appears in our photographs. Often a storm from the south dashes great breakers upon the shore and in such weather a launch is impossible and must be postponed until the sea is calm.



An Ansaldo cargo steamer in her war paint

The Ansaldo Company is not permitted to make public details about the vessels it has built for the Italian Navy since the war began, but it may be said that it has steadily turned out a stream of submarines, mine-layers, scout-boats, destroyers, torpedo boats, cruisers and battleships, a few of which are pictured herewith.

The scout "Carlo Mirabello" is a most interesting type; the naval architects of the company claim that it is the swiftest vessel for its size in the world. Its speed is 37 knots or a little more than 42 land miles an hour, and its displacement is 3,000 tons. So far did it surpass the expectations of the Italian naval authorities that it was accepted as an ideal type for its class. Its armament has not been revealed.

Of the battleships built in these yards the "Cristoforo Colombo"," 28,000 tons and "Giulio Cesare," 23,000 tons, were the largest of those launched before the war drew a veil of secrecy over the operations. The largest mercantile vessel built there

(Concluded on page 115)

Making the Aviation Engine Fit for Any Altitude

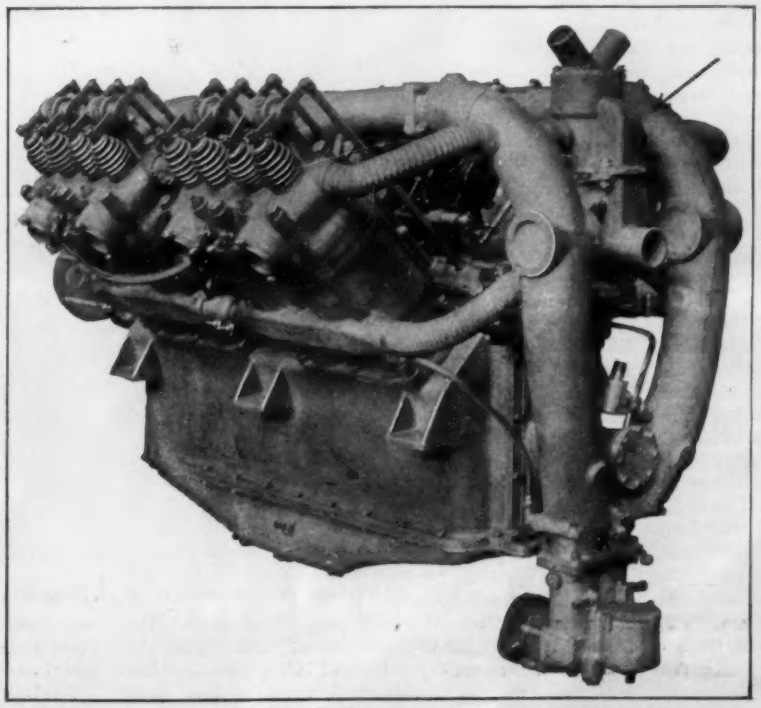
AN aviation engine is called upon to operate under the most adverse conditions, yet it is expected to function perfectly. From the start on the ground made in the heat of a broiling summer sun, it must climb to the arctic climate of the clouds in less than half an hour; and from the lowest to the highest levels the engine must adapt itself to all temperature changes. Yet all the while the fact remains that an engine does its best work when the water in the cooling system registers 180 degrees of temperature.

Various methods are employed in controlling the temperature of the cooling system of an airplane engine. The speedy scouts now used over the battlefields of Europe are provided with adjustable radiators; that is to say, the radiators have shutters that may be more or less closed so as to control the quantity of air passing through them. On the ground the shutters are generally wide open, during warm weather; but as the pilot ascends he closes the shutters more and more to compensate for the lowering temperature of the air through which he is passing. This method is excellent, to be sure. Yet it is obvious that a pilot cannot give much thought to the cooling system when he is engaged in fighting enemy machines. As often as not he pays no attention to the temperature of the cooling system, and the first notice he receives of this neglect is when the engine begins to misbehave in a fashion that forebodes trouble of the most dangerous kind.

In its ninth year of existence, the Sturtevant engine of American design and manufacture makes use of an automatic temperature control, so that the engine adjusts itself to its surroundings without troubling the pilot. The thermostat, which controls the cooling system, is mounted above the water pump cover, which furnishes a support for the body casting and at the same time provides the water by-pass connection for the pump inlet. Water passes from the engine heads by way of rubber hose through the top of the long-jacketed inlet pipes, and from there it is conducted by short rubber nipples to the lower chamber of the body casting where it strikes the thermostatic element. By means of a double valve arrangement, it is then directed either to the radiator or to the pump inlet through the by-pass duct already mentioned.

The double valve is directly connected to the thermostatic element. When the water is cool, all of it is by-passed to the pump inlet. At a temperature of about 170 degrees F. the thermostat expands and allows part of the water to go over to the radiator. When the temperature reaches 180 degrees, the by-pass valve is entirely closed, and all the water passes to the radiator. The sizes of the two valves are such that, should failure of the thermostat element occur, the by-pass connection will close and the water circulation of the engine will be the same as when no thermostat is used.

In actual service the Sturtevant engine has functioned perfectly with the automatic temperature control, and no trouble has been experienced with the thermostat. The particular advantage of this method of water temperature control lies in the fact that it is very light, weighing less than five pounds complete, and also the automatic nature of the control. An airplane may leave the ground when the air is at a fairly high temperature and in a very short time be at an altitude where it is extremely cold. Under such conditions the use of the thermostat insures smooth engine operation, and there need be no fear that the engine will die down and stall due to extreme cold. When it is known that the machine is to be flown at temperatures well below freezing, it is desirable, and in fact necessary, that the radiator water be diluted with alcohol or some other liquid to prevent freezing which otherwise would occur.

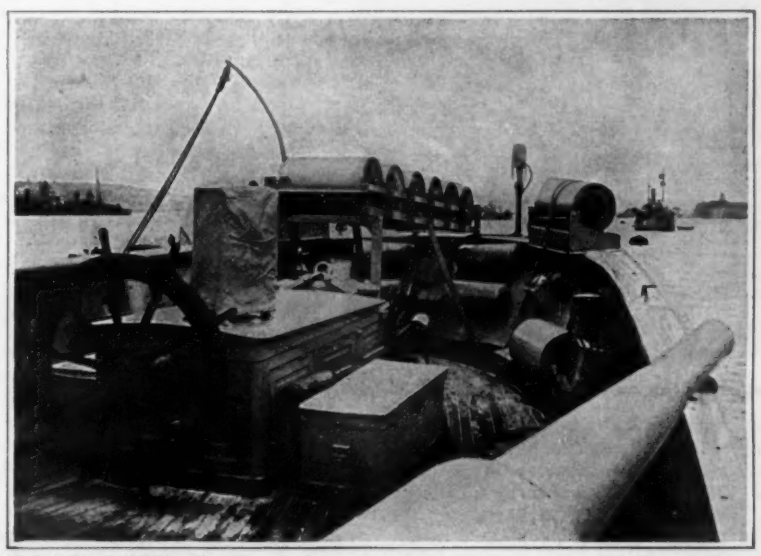


Aviation engine equipped with automatic temperature control, indicated by arrow

The Depth Bomb and the Patrol Boat

THE appearance of the depth bomb in U-boat warfare has enormously increased the offensive value of the patrol boat. Armed with this most efficient weapon, even the smaller converted craft, such as former steam yachts and motor boats, have become a terror to the U-boat when it is operating in the restricted waters toward which the ocean traffic converges in its approach to Allied ports and harbors. This is true even of such craft as have only a moderate speed.

For when a submarine submerges anywhere within range of the comparatively small guns carried by motor boat patrol vessels, there is an excellent opportunity for one or more of these craft to reach the point at which the enemy has disappeared, and drop its bombs before the U-boat is able to get beyond the radius of destruction of their heavy explosive charge. Broadly speaking, the object of the patrol is to keep the submarine down, and the fact that even the smaller craft, to say nothing of the swift and powerful destroyers, are now carrying the depth bomb, has exerted a powerful moral effect upon U-boat commanders.



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How depth bombs are carried at the stern of a patrol boat

We present an illustration of the quarter deck of the United States patrol boat, "Harvard," which was formerly an American yacht. It is of particular interest as showing how the depth bombs are carried ready for instant use. It will be seen that at the stern of the vessel is an inclined steel rack, loaded with half a dozen of the cylindrical depth bombs. Normally, the firing mechanism is restrained by a key, which is released when the bombs are to be used. Also a graduated disk is provided, by the operation of which the bomb can be set to detonate at any predetermined depth. The firing is due to hydrostatic pressure acting upon the firing mechanism at the depth for which the latter is set.

When a submarine has been seen to submerge, the patrol boat dashes for the spot and follows along in the direction taken by the enemy; and the accuracy with which the bomb is detonated within destructive range of the submarine is determined by the judgment and skill of the patrol boat captain.

It will be noticed that in addition to the half dozen bombs in the rack, there are two other depth bombs mounted on the rail and held in place by a cable provided with a catch, which, on being tripped, allows a bomb to roll off and drop into the sea. Below each of these and resting in chocks on the deck are two more bombs, making ten in all that are carried at the stern ready for use.

The rack containing the half dozen bombs is inclined downwardly so that as each bomb is released it will roll toward the stern and drop overboard. The four cylindrical containers carried on the bulwark plating are probably smoke bombs which, on being thrown overboard, are ignited by the action of the water and produce a dense smoke screen.

World Markets for American Manufactures

Edited by LYNN W. MEEKINS

A department devoted to the extension of American trade in foreign lands

Brickmaking Machinery for Europe

TO provide material for reconstruction and for thousands of new buildings after the war Europe will need a considerable quantity of brickmaking machinery. When the gigantic plants in the United States that are now producing munitions turn to the output of other commodities, upon the return to normal conditions, they can continue to sell their products in Europe if they will examine the field now and prepare to fill its coming demands.

The market for brickmaking machinery will be found more or less general all over France, which uses large amounts of clay construction materials. For the interior walls of houses a flat brick measuring 9 by 5 by 1 inches (frequently made three inches thick instead of one, but with two spaces lengthwise) is most frequently employed. A special type of machine is needed, which it would be desirable for exporters to have in stock. Tiles for roofs, almost universally of clay, are either of a single arch or of one or two undulations, the 10 by 5 by ¾-inch size being the average. American machinery for making these tiles would probably be serviceable without alteration and should find wide sale.

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Drying green brick after molding

The principal building materials used in the United Kingdom are stone, bricks, tiles, and terra cotta. There is consequently a steady demand, especially in normal times, for brickmaking machinery, according to the American Consul at Nottingham, England. It is expected that from 150,000 to 200,000 new workmen's dwellings will be urgently required after the war. Ordinary bricks in Great Britain are manufactured by two processes, the plastic and the semidry, special machinery being needed for each process. The kinds of bricks used are wire cuts, semidry, white, pressed facings, and pressed. There is also a limited demand for ornamental bricks of all descriptions. In addition to their use for building purposes, bricks are required for sewers and conduits. Although the brickmaking machinery now used is all of British manufacture, American firms wishing to install improved methods of producing and handling bricks will have attractive opportunities in England. One of the most successful British-made machines now costs nearly $3,000, compared with less than $2,000 before the war.

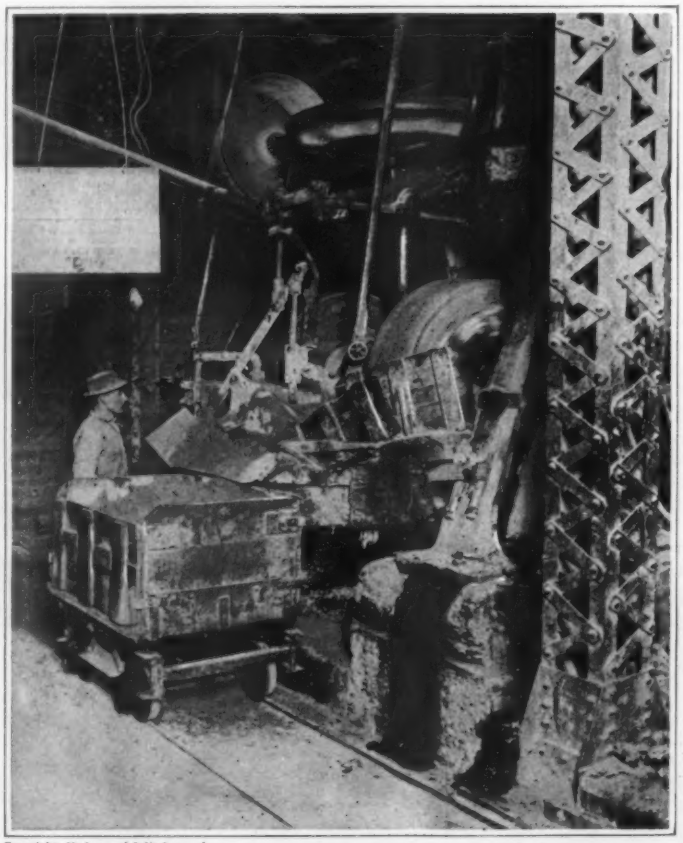
Fire destroyed a large portion of Saloniki last summer, and in that city, together with the rest of New Greece, bricks are in heavy demand for both temporary repair work and permanent construction. About 15,000,000 bricks and 5,000,000 tiles are produced by factories in the Saloniki district, and only one of these plants has brickmaking machinery, which consists of clay pulverizers and presses of French and Swiss manufacture. The need for increased production means a market there for apparatus from the United States, which is admitted free of duty.

Of the neutral European countries Spain seems to offer the most promising openings for the sale of American brickmaking machinery after the war. Little such machinery is now in use, practically none imported, and none manufactured locally, although there are 2,425 plants for making common brick, roofing tiles, and pavement brick scattered throughout the kingdom. The vast amount of hand labor employed could be advantageously replaced by machinery. Bricks used in the Barcelona district are generally either 1.77 inches or 2.16 inches in thickness and cost $7 and $8 per thousand. The walls and partitions are constructed of these, the exterior of the building being covered afterward with concrete stucco.

With the exception of hand-operated flattening machines and machinery for fireproof or grit-stone products, all necessary apparatus for brick and tile manufacture is produced in Switzerland. Machinery imports consist of special devices for stone breaking, laminating rollers, and a few other articles from Germany, valued at about $25,000 yearly. In 1916 Switzerland exported more than $180,000 worth of brickmaking machinery, of which over $100,000 worth went to France and Italy.

The large and continuous demand for bricks in Holland is supplied almost wholly by domestic producers, who use machinery made in that country, and the American manufacturer is not likely to make much headway there. Denmark, too, is practically self-sufficient in this line, though it has imported some brickmaking machinery from Sweden and Germany. The usual size of the brick made in Denmark is about 9.05 by 4.33 by 2.16 inches. All parts of the country abound in clays suitable for brickmaking.

France, Great Britain, and Spain are the European countries in which the American exporter of brickmaking machinery has the best chance of selling his product after the war. Everywhere he will encounter active competition on the part of British, Swiss, and other manufacturers, and in the present neutral countries Germany will make a strong bid for the trade. Representatives should be sent to visit the more important manufacturing centers before the end of hostilities.



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Rock-crushing machinery of a type imported by Switzerland

A Necessary Document in Foreign Trade

IT is the opinion of a great many American exporters that the proposal of the United States Railroad Administration to discontinue the issuance of through export bills of lading on September 30th will not only discourage manufacturers from marketing their goods abroad but will even drive number of commission houses and foreign freight forwarders out of business.

"To do away with the through bill of lading will put a crimp in our trade with the Far East, where we have been building up a substantial business," said a prominent merchant on hearing of the projected step. "We have been able to send our goods across the Pacific without worrying about periscopes on the horizon." Our exports to China in May, 1918, were over $2,000,000 greater than in May, 1917, while to Japan we sent twice as much merchandise, the increase exceeding $12,000,000.

Under existing arrangements the shipper delivers his consignment to the railroad company, whose receipt he exchanges for a through export bill of lading signed by an agent of the trans-continental line. The latter document, accompanied by the other customary papers, enables him to draw immediately upon the credit established by the purchaser. There is not much more to the transaction than selling f. o. b. mill, so far as the financial end is concerned.

What will happen if the through bill of lading is discontinued? This is what one experienced exporter has to say about it: "The American manufacturer who accepts an order from the Orient will have to send the goods to San Francisco, Tacoma, Seattle, or Vancouver under a railroad bill of lading, obtain an ocean bill of lading upon clearing the shipment from one of these Pacific ports, forward this document to New York, where the credit is established in most cases, and present it to the bank. From thirty to ninety days will elapse between the time that the goods leave the factory and the time of payment. The interest charge, of course, will have to be passed along to the foreign buyer, together with the additional expenses of employing an agent on the Pacific Coast to handle the shipment there, and other charges for storage and insurance while the goods are awaiting the steamer. But only the larger concerns have sufficient capital to tie up in this way. Delaying payment and adding to the red tape of foreign shipments will discourage the rank and file and keep many out of the export business when everything possible should be done to encourage them."

The through export bill of lading is a vital part of our foreign trade machinery. It places manufacturers in the interior of the United States in a favorable position to compete with those on the seaboard. Its importance cannot be overemphasized at the present time, when the only dependable route available from the industrial districts of the East and the Middle West to China, Japan, the Philippines, India, and other Oriental markets, as well as Australia and New Zealand, is overland and across the Pacific.

It has been suggested that the Railroad Administration may have two ends in view in eliminating the through bill of lading. One is to reduce clerical forces and conserve man power: the other, to relieve congestion at Pacific ports. It is doubtful, however, if either object could be achieved, for it would be necessary for special agents to handle the ocean bills of lading at the seaboard and large shippers would have to maintain their own organizations for that purpose; and the break in the continuity of shipments that would occur between the time of arrival at the coast and the time of dispatch on the steamer would add to the congestion of freight instead of diminishing it.

For one year more than 500 carloads of export freight

(Concluded on page 115)

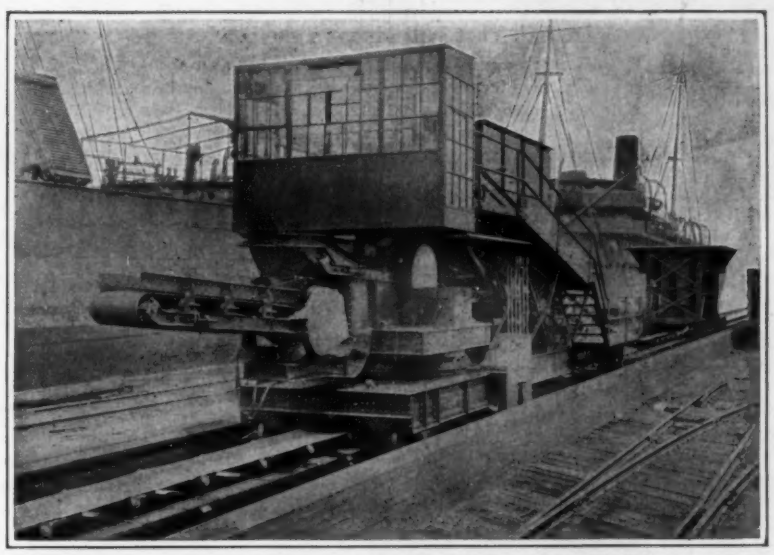
Electric Weighing of a Moving Mass

How the Scale is Being Applied to the Conveyor Belt

By J. M. Bird

MEN in the conveyor business realized long ago that their new method of handling called for a new method of weighing. If the weight of a continuous stream of material can be obtained only by breaking the continuity of the stream to load and unload it on a car or a scale platform for weighing, it is clear that, in many places where all the other requirements of the situation practically dictate its use, the conveyor is not going to be available. With equal clearness, if we can weigh loose material while it is on the conveyor, this fact is going to be of itself a conclusive argument in favor of the introduction of the conveyor in many places where its use has not previously been thought of.

The problem is that of weighing the material as it runs. We can do this if we can find the size of the stream and the speed at which it moves; but we meet here the old problem of gross and tare, and in a peculiarly aggravating form. For a conveyor is a receptacle, just as much as a wheelbarrow or a box car; and just as in every other case, its weight has to be deducted from the figure obtained when receptacle and contents are weighed together. But like an ordinary receptacle, a conveyor's weight changes; it never empties twice to the same degree of cleanness. Then the special difficulty of variable speed multiplied by variable load complicates the situation. There are plenty of methods of getting separate gross weights and separate tare weights; but they all get into difficulties in the matter of finding net weights, the only thing anybody cares about. For to measure a variable gross and variable tare, and then to subtract each item of tare from its own particular gross, is apparently a problem in infinitesimal analysis, calling for a man to deal with it, rather than for a machine.



The installation for unloading from car to ship, weighing the material as it passes

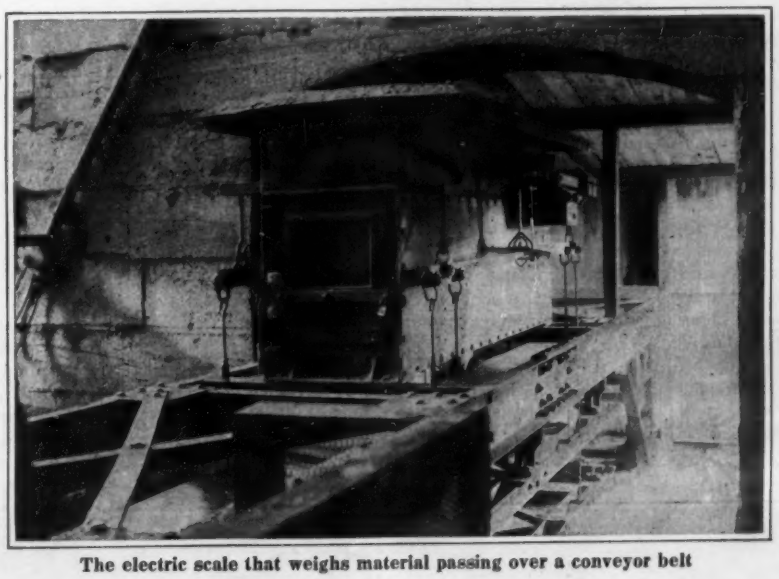
A conveyor scale is on the market, however, which solves the problem, and in a very simple way. It merely weighs the loaded and unloaded parts of the conveyor against each other, on the same scale but on opposite sides of the fulcrum. Obviously this meets the situation perfectly; and the only concern becomes now the matter of adding up the continuous record to get a total. To put the thing on a mathematical basis again, we have evaluated our infinitesimal elements, and now we must integrate. And here, whatever else be required, three issues must be faced squarely. The free motions of the scale beam must not be interfered with in the slightest; the scale is going to be used in a factory or an engine-room or in the open, and it must work under the prevailing conditions of dirt and dust in such places; it must stay right and work right with the kind of treatment it is likely to get from the unskilled men who will probably handle it. Close observation of four attempts to use mechanical integration made it clear that this was not capable of fulfilling the requirements; so electricity was called in to do the job of totalizing.

Here recourse was had to one of the oldest and best known laws of electricity—volts multiplied by ohms gives amperes. Knowing this, if we can get a resistance proportional to the size of the stream of material, with a voltage proportional to the speed of the conveyor (or vice versa, for that matter), the trick is done as soon as we measure the current used. For speaking broadly, total weight carried is the product of weight by velocity, even though both of these factors be variable. Accordingly, under the circumstances outlined, amperes of current used will be proportional to total weight carried; and all we need do to reduce the thing to an operating basis is find the factor of proportionality.

When it comes to working out this idea, many interesting points occur. The voltage problem is simple enough; a special dynamo is geared to the conveyor so as to give a voltage regulated by the speed of travel. But the matter of resistance is not so simple, and affords field for the exercise of much ingenuity.

A vertical plunger is half floated in a tube of mercury, its position being governed by the net load passing over the scale pans. In order to eliminate friction as far as is humanly possible, the mercury in the tube is topped off with an oil which will not form an emulsion with the metal; and the upper part of the plunger bears in this oil. The plunger is hung up with the scale load by means of a lever, in such fashion that as the load increases the plunger falls. In falling it displaces mercury, causing the latter to rise; in rising again, it leaves room into which the mercury falls. As the mercury rises and falls, the oil escapes into or from a reservoir on top of the tube, so that the tube itself is always nicely full—of mercury up to a certain level, of oil above. But along the inside of the tube is a series of contact points connected with resistance members. The higher the mercury rises, the more of these are submerged and put into circuit, and with them the more of the resistance members are brought into play. Of course the measuring current does not pass through the mercury; the plunger merely operates a relay which throws the resistance members one after another into or out of the measuring circuit as the mercury rises or falls.

The calibration of the scale is an extremely delicate and interesting business. It is not necessary to apply a changing weight, or even a real weight at all. The exact weight of the plunger is known, as is the exact length of its lever arms; so the exact height which it will take under a given load is known. The conditions corresponding to a given load can then be reproduced with accuracy. The auxiliary circuit normally operated by the plunger can equally well be operated by hand, to bring in the resistance members one at a time. So the plunger and the conveyor and the load upon the scale-pan do not figure directly in the calibration at all.



The electric scale that weighs material passing over a conveyor belt

The resistance members are in series, not in parallel. They are made longer than necessity can possibly require; and of course each has two points of contact with the measuring circuit. One of these is fixed when the apparatus is built; the other is left for adjustment. By placing this contact tentatively at a greater or less distance from the fixed one, a greater or less resistance is introduced into the circuit. The work of calibration consists in determining just where this second contact must be located upon each resistance member, and in putting it there. The contact, it will be realized, does not remain permanently adjustable; after its proper place is found, it is fixed in that place.

The conveyor belt itself is not present during the tests, but the dynamo which it operates is; the speed at which this dynamo runs is directly translatable into conveyor speed, and is used as the basis of calibration. The voltage at which the dynamo is running during calibration is known. With a given number of resistance members in action, there is a certain hypothetical load upon the conveyor which isn't there; and it is known at what speed the conveyor should run under that load, at the given voltage, to maintain the desired proportionality between current used and total load passing over the weighing pan. The adjustable contact is placed at random; the speed at which the dynamo does run is measured; the contact is moved to bring in more or less resistance until the desired balance between speed and resistance is attained.

Since the resistances are in series, there is no piling on of errors. The test is made for the first member; after the contact is located and fixed in position on this member, the second resistance is brought in and calibrated—not separately, but of necessity in series with the first. Then the first three resistance members combined are treated, the first four, the first five, and the result in each case made a part of the apparatus by proper location of the upper contact on the final member of the group under test. The extension of the calibration to the hundred-and-some-odd resistance members takes time—several days, in fact; but when it is done, there is just the right amount of resistance in each member to accomplish the desired result. Moreover, an error made in locating one of the contacts affects that contact alone. This of course would not be the case if it were the added resistance that is measured and adjusted; errors would then be accumulative. But by measuring the total resistance at each step, the probable error is held constant throughout. And we are told that far greater accuracy is attained by thus adjusting the resistances to give the desired factor of proportionality, than would be the case if we allowed the resistances to adjust themselves, and then attempted to determine the relation between resistance and weight passing over the scale. This way, we make sure that the proportionality is the same throughout the range of the apparatus; it would not be possible to manufacture the resistance members so uniformly as to produce this result, if we went about it from the other end.

An interesting feature of the calibration is the device employed for measuring the speed of the dynamo. Calibration must be done with the utmost exactness; we dare not call upon the dynamo to do any mechanical work in turning a counter or dial hand or moving a pen over a sheet of graph paper. The friction of the counting process on the dynamo shaft is accordingly reduced to a minimum by asking that shaft only to open and close a relay circuit at each half revolution; and the relay circuit then does the mechanical work of counting. But even in the ordinary contact there is some friction; and this must be overcome, so far as possible, by a special form of contact. In the present case a small circular plate rotates with the shaft, bearing at opposite points on its circumference two tiny needle points; and at each semi-revolution, these points sweep through two drops of mercury which stand up to meet them from the surface of a little table. It is pointed out that the mechanical effort required of the points in penetrating the near surface is very small, since penetration is the slightest; and, such as it is, a good part of this effort is returned by the kick which the points get on emerging from the far side of the sphere.

With the scale set up and in operation, the moving parts are reduced to a minimum. There are, in fact, no mechanical movements save the depressing of the scale pans and the movement of the plunger in the tube. These, being simple lever actions, can hardly be affected by dirt or rough usage; and we have in fact seen a scale

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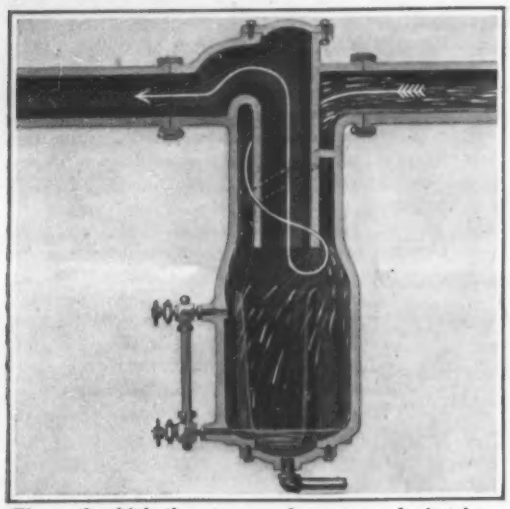
Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



The path which the stream of compressed air takes in being freed of its moisture

Getting Dry Compressed Air

THE presence of water in compressed air is a source of great inconvenience in the operation of pneumatic tools, sand blast machines, etc. To secure dry compressed air it is necessary to remove the water from the air after the air is fully compressed. Coolers are generally used to bring the air into a suitable condition for giving up most of the water which it contains, but this treatment merely serves to condense the water vapor and not eliminate it. The air separator which we illustrate efficiently removes this water.

In the operation of the separator centrifugal force is utilized as the means of freeing the air of water. The air and water entering the separator pass through a helical path formed about a central core, resulting in a swirling motion. As water is several hundred times heavier than air and does not make the turns so easily, it is thrown out of the path of air against the outer wall and adheres there, to trickle slowly down and accumulate in the receiver at the bottom. The air makes the turn easily and passes on its way out of the separator free from water.

The separator, because of its correct design and consequent satisfactory operation, is rapidly coming into general use on compressed-air lines. It is particularly suitable for use in connection with sand blast machines, where water in the the air is very detrimental to the efficient operation of the blast. If any water is allowed to enter the sand chamber with the air, it causes the sand to pack and prevents it from flowing freely from the blast nozzle, necessitating frequent shut-downs for cleaning. Pneumatic tools of all kinds operate more satisfactorily when the compressed air is practically dry.

Small Auto Used for Coal Delivery

BY the use of a simple device attached to the rear of your small pleasure car it can be turned into a commercial car in a very few minutes and serve many purposes. One man, a coal dealer, has a specially designed coal trailer made which attaches to his runabout and carries a load up to a ton weight. This was found to be a great convenience for delivering small loads which might be attended to while taking orders on the route.

The coal truck is a two-wheel semi-trailer which couples to the car by means of a rocking fifth wheel on the rear of the car. This is covered, when not in use, by a metal boot such as is used on runabouts.

The semi-trailer is of rather an unusual design. It can be unloaded quickly by turning a crank which operates a ratchet and this deposits the load in the desired spot by tilting the funnel shaped body. This body swings upon a curved flange, one on each side of the metal body. A few turns of the crank bring the body back to position.

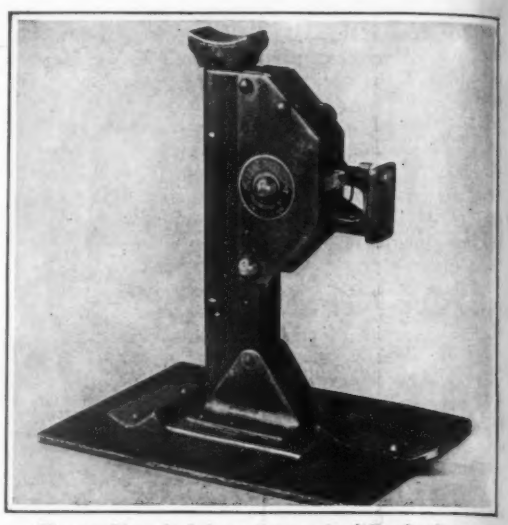
One advantage of this semi-trailer is that it will turn in a narrow street or yard where the four-wheel trailer could not be used. It can be backed to any position without the aid of an extra man.

This arrangement is especially useful for the dealer who has a lot of small orders to attend to, thus saving the large trucks for heavy work.

A Jack That Will Always Take Hold

IN an emergency it sometimes happens that an automobilist has to use his jack on ground which, because of its softness or other peculiarity, makes a large base desirable, if not actually necessary. But in the majority of cases an abnormally large base would be merely a nuisance; no one wants to be permanently burdened with a jack that takes up as much space as a dining-room table, just because once in a great while such a tool would come in handy.

The obvious answer to this double demand is a jack with an adjustable base. This of itself is hardly a practicable suggestion; but there is no reason why we cannot have a jack with a supplementary base. In fact, we actually have such a jack right now, in the model illustrated herewith. When the regular base attached permanently to the jack is not adequate for the job in hand, the additional foot-piece is put in position beneath the regular one and clamped in place by the turn of a screw. The autoist has then a jack with sufficiently large base to get him out of any difficulty in which he can well expect to find himself. And when he is safely out, his supplemental base is flat, and can be packed away against the bottom or side of his tool compartment without occupying any great amount of space.



The auxiliary jack base for use in difficult places

Polishing Floors with Electrical Muscles

WITH the harnessing of electricity much of the hard work connected with polishing of any kind has been abolished forever. In the matter of hardwood or linoleum waxed floors, for instance, there is now available an electrical machine which does the work in the minimum of time and with no more labor than that necessary to push it over the surface.

Originally, the electric floor-polishing machine was designed for the large telephone building in New York city, and through the use of this machine the owners of the large office building were able to replace men with women since great muscular effort was no longer required. Polished floors, if kept bright and clean, are more sanitary than floors subject to mopping and scrubbing. Furthermore, polished floors are less expensive to care for, and it is largely for that reason that they are being more and more employed in office buildings.

The polishing machine, which is illustrated in the accompanying engraving, weighs about one hundred pounds. It is mounted on rollers, and by means of the long, carriage-like handle, it can be readily pushed obout. The polisher proper consists of a cylindrical brush driven at high speed by a one-quarter horse-power electric motor. The brush is made of two semi-circular aluminum cylinders, mounted upon a drum of the same material, revolving in ball-bearings. Cylinders and motor are connected by a chain and sprocket wheel. The brush is set to revolve at right angles to the plane of the floor, giving a buffing action that reduces the amount of wax required.

A concealed motor does all the work of polishing a waxed floor

Scope of Trade Mark Registrations

By E. B. Marshall

WHILE the law prohibits the registration of any trade mark which so nearly resembles a registered or known trade mark, owned by another and appropriated to goods of the same descriptive properties, as to be likely to cause confusion or mistake in the mind of the public, the application of this law to particular cases often leads to confusion.

In the case of Thum Co. vs. Dickinson, recently decided by the Court of Appeals of the District of Columbia, it was held that there is absolutely no excuse either legally or morally for an even approximate simulation of a well-known trade mark appropriated to goods of the same descriptive properties. When it becomes apparent that such an attempt has been made, the two marks should not be examined with a microscope to detect minute differences, but rather, should be viewed as a whole, as the general public would view them. The points of similarity are more important than the points of difference and it is upon them that emphasis falls

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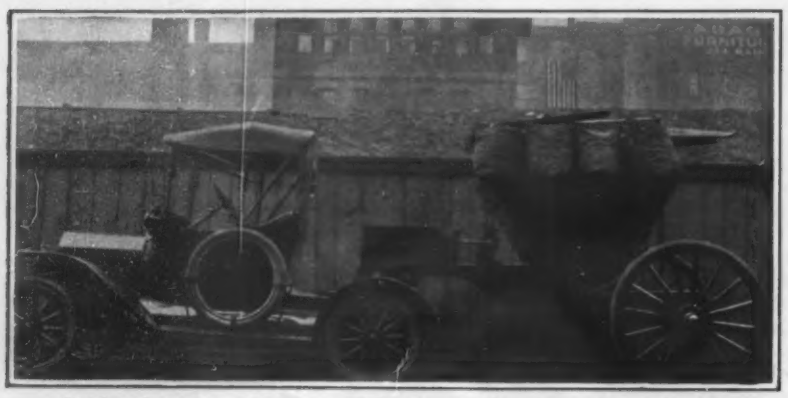


Putting the passenger car to work hauling coal by means of a semi-trailer

The funnel shaped trailer dumps its load at a turn of the crank

The Current Supplement

THE war has been a great awakener, for it has opened the eyes of the public to the decidedly rudimentary character of numberless enterprises which were supposed to be marvels of efficiency, but which in the emergency, have failed to make good. Take our railroads, for example, which have been found to be only about sixty per cent efficient. Now we find that our ports are equally as wasteful in time, effort and money, and that we are by no means prepared to load and unload the great fleet of ships now building in an efficient manner. Of course, many people knew that the methods of handling freight prevailing in our ports were unsatisfactory, but it has has taken the war to bring home to us the actually primitive character of the average wharf and its equipment, and the procrastinating methods our port authorities. A paper in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2223, for August 10th, on *Ports and Terminal Facilities* discusses this important problem, which is a matter of concern to every producer in the country. Another chapter of the *Anomalies in the Animal World* appears in this issue, and deals with the senses of fishes. It is illustrated by several cuts. The food of an army is almost as important as its ammunition, so the article on *Army Rations*, which gives a comparison of what the soldiers of the principal countries of the world eat, will be of wide interest. *Radiotelegraphy* describes the uses of this means of communication, and its possibilities in the war. It is illustrated by a number of excellent photographs. *A Theory of Color Vision* develops a theory based on the interesting phenomena of the selective action of the eye, and is illustrated by several diagrams. Other papers in this issue are *Game Farming for Pleasure or Profit* and *Notes on Testing the Hardness of Metals*, which considers the right use and application of the methods for testing hard ness.

A Navigational Safeguard for Trans-Atlantic Flight

(Concluded from page 101)

conflicting tides and air currents may set up a type of sea that will be quite misleading—not to mention the fact that low-lying fog may entirely obscure the ocean's surface from the pilot aloft.

Rear-Admiral Bradley A. Fiske, U. S. Navy, has made the most promising contribution to the solution of oversea aerial navigation, and one that is extremely simple in principle. He introduces the desired element of precision by proposing that the air pilot borrow freely from the practice of the mariner and, in fact, virtually employ one of the latter's well-tried aids, the mechanical log. This instrument, however, would serve the airman in two ways instead of the single one in which the seafarer uses it. The sailorman tows the log behind his ship to obtain a record of distance covered in a given interval. Admiral Fiske would utilize the log to record headway and to indicate also whenever and to what extent the flying machine might be set sidewise by winds blowing laterally across the intended course.

The mechanical log would travel through the water and be towed astern, a distance of a thousand feet, by a light steel wire leading from the aircraft; and the plane, instead of flying high aloft would hold its position close to the surface of the sea—probably not more than a hundred feet above it. The log would not be affected by air currents while the plane would be. That is to say, if the atmosphere were calm or the wind blowing parallel with the chosen course, then the log and the trailing wire would lie astern and coincident with the centerline of the machine's fuselage; but were the wind blowing laterally the plane would be drifted accordingly and the wire between the aircraft and the log would assume a more or less pronounced angle to the true course, depending on the force of air current inducing the leeway.

By having the wire at its upper end attached to a suitable yoke, Admiral Fiske provides a medium by which the departure to port or starboard would be indicated upon a dial in the cockpit. The pilot, then, would head the plane up against the wind until the line leading to the log was brought again into coincidence with the needful compass course. His machine would actually be pointed away from the objective, but the net or true advance of the aircraft would be the correct one. He need not bother himself about the force of the disturbing wind—his check would be a visual one night or day, and he could instantly swing his plane to neutralize the disturbing factor.

By drawing up the log once an hour, for instance, and reading its recording dial, it would be an easy matter to establish with reasonable closeness the distance covered on the journey. The time the log were out of water—say five minutes—would introduce a small error, for which allowance could be made. At the outside, the aggregate error would probably be considerably less than two per cent. In a flight of 1,200 miles this leeway would not be of serious moment, because when nearing his destination the pilot could mount high enough to command a field of observation of half a hundred miles in radius. This would allow generously for any lateral drift which, in a passage of 1,200 miles, would certainly not exceed 25 miles at most.

Watering the Garden by Long-Distance Telephone

(Concluded from page 105)

toilet bowl. In this manner he can divert the water, coming from the reservoir, to the pipe leading to a discharge tank. The latter, in turn, is connected to the perforated pipes or sprinklers arranged about the roof garden so as to play streams of water on the plants.

In reality, the toilet is on the third floor while the roof garden is on the second. Thus considerable pressure is obtained through the fall of water; and the holes in the pipe are so small that the water has plenty of time to reach every inch of pipe all the way to the very end. When Mr. Schneider is at home he waters his garden by turning the two-way stop-cock to the proper position and then pulling the release chain. He pulls it as many times as may be necessary to water the plants.

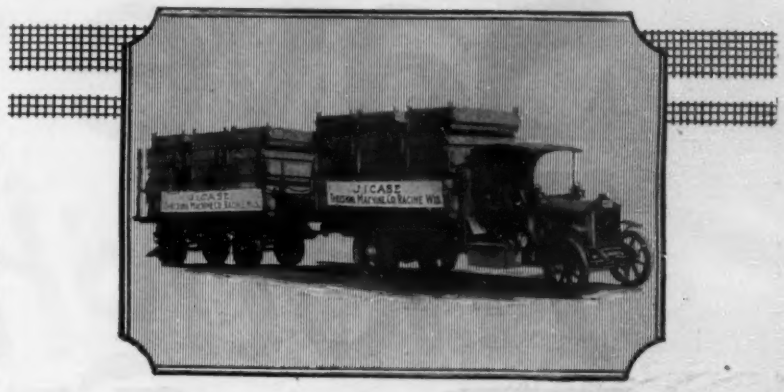
But during the summer months Mr. Schneider goes to the country, and no one is left in his home to care for the plants. Then it is that he resorts to the long-distance telephone. The arrangement, in this case, is also shown in the diagram. In the same room as the telephone there is installed a harmonic telephone transmitter or microphone, consisting of a thin metal disk carrying a contact point, or a tuned string or wire, which, when set vibrating by the telephone bell, closes a circuit. This circuit immediately closes a second circuit which includes a powerful electromagnet. The latter, acting on an iron weight or armature attached to the handle of the toilet chain, pulls the chain and operates the irrigating system.

And then there are the gold fish! Mr. Schneider, who is a well-known inventor in the motion-picture field, has an aquarium which operates in much the same manner as his garden. As the telephone bell rings the fish are given a feeding, coincident with the watering of the garden.

When away from home during the summer, Mr. Schneider has merely to call up his home on the long-distance telephone. "Central," following the usual custom, rings the bell several times and unwittingly waters the roof-garden and feeds the fish. Then she reports that "The party doesn't answer," much to the satisfaction of Mr. Schneider who visualizes the wetted flowers and vegetables and the satisfied fish—without charge! Of course, the system in no way interferes with the telephone service, and inasmuch as there is no physical connection of any kind there can be no ruling against it.

Still another example of Mr. Schneider's ingenuity is a system of mirrors, whereby daylight and sunshine are reflected into the dark corner of his garden, in the shadow of adjacent tall buildings. He claims that the reflected light has much to do with improving plant life in those dark corners.

Warner Trailers
For *Your* Hauling
Save Men and Trucks—Speed Deliveries



And—There Isn't Any Task Too Stiff

For every kind of load and behind any motor vehicle, Warner Trailers will save man-power, trucks and money and give you quicker, better deliveries.

Save man-power because the truck driver cares for two loads—the truck's and the trailer's (Warner Trailers double the load hauled by the truck alone).

Save trucks by making one truck ***haul*** (not carry) double its rated capacity. The J. I. Case T. M. Co., Racine, says, "By the use of the Warner Truck Trailer we have been able to do without extra trucks which we would have had to purchase."

Save money on upkeep. There isn't any to the trailer. Double the freight moved and only the upkeep of the truck as before.

WARNER
HEAVY DUTY
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TWO AND FOUR WHEEL TYPES

Another Saving—You save the nation's railroads when you ship by motor truck train—and Warner Trailers are essential to the profitable operation of these trains.

The Highest Type Trailer

Our trailers are as sturdy as any truck. Of highest grade construction with many patented features which count big in ease and practicability of operation.

An Exclusive Warner Feature

Our universal Ball and Socket Hitch eliminates all coupling pins. Operates like your shoulder joint. Allows for every conceivable position of the truck and trailer. Eliminates all binding strain in going over bumps, around corners or when truck is going up hill and trailer coming down even at extreme angle.

There's a Warner Trailer Doing Your Kind of Hauling

We build both two and four wheel types in all capacities. Users find them all we claim. And we're sure they are used in your particular line of business. Write us for performance records and other data.

WARNER MANUFACTURING CO.
145 Bushnell Avenue, Beloit, Wis.

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Save the *Thoughtless* Dollars

"I got the sweetest hat today. And, my dear, of course, I didn't really need it, but—"

* * * *

"What if it is only a few blocks? Here, taxi!"

* * * *

"I know I'd feel a lot better if I ate less, but I simply must have a big order of—"

* * * *

Over there in the Picardy mud, pock-marked with significant craters and "plum-caked" with unspeakable things that once were men, our soldiers can't hear all that some of us are saying. Good that they can't, isn't it? It wouldn't make it any easier to stand firm against those blood-crazed, grey hordes who come on wave after wave because they believe their Kaiser is "God's anointed shepherd of the German people."

* * * *

It isn't that we Americans are a selfish people. We have simply been thoughtless.

Money is needed to win this war—let's give it. So far, we have been asked only to lend—to lend at a good round 4% interest. Turn your THOUGHTLESS dollars into War Savings Stamps.

NATIONAL WAR SAVINGS COMMITTEE, WASHINGTON

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THE PUBLISHERS OF SCIENTIFIC AMERICAN

Italy's Contribution in the Shipping Crisis

(*Concluded from page 109*)

was the "Duilio," 23,000 tons, destined to ply between Genoa and Buenos Aires as a passenger steamer *de luxe*.

One of the enterprises in which the directors take most pride is their development of the Diesel motor for ships. In the Fiat San Giorgio yards at Spezia they are building many of the vessels of their new fleet, and equipping them with their own internal combustion engines of this type, made in their factory at Turin. The vessels building at Cornigliano Ligure, while of the same general type, have American turbines.

They are supplying these motors to the Italian navy also and equipping scout boats and submarines with them. The motor installed in the standardized 8,100-ton freight steamers is of four cylinders, and each develops 1,000 brake horse-power at 110 revolutions per minute. Another type is made so compact that three of them can be placed abreast in a very fine-lined steamer, like a swift destroyer or scout, and together they develop 6,000 horse-power on a total weight of 216 tons net, or of 325 tons including engine-room equipment, auxiliaries, propellers and shafting, giving an estimated speed of 25 to 26 knots. These are direct-reversible. The motors for submarines give approximately the same power and speed with six cylinders and a weight of but 70 tons. They are not direct-reversible.

The dimensions of the standardized 8,100-ton freight steamers, of which four are already in commission and 22 in construction—all, be it said, of material bought in and shipped from the United States—are as follows: Length over all, 390 feet; length between perpendiculars, 378 feet; breadth, extreme, 50 feet 9 inches; depth (moulded), 30 feet, 3 inches; draft (loaded), 24 feet 6 inches; deadweight, 8,100 tons; gross tonnage, 5,580 tons; fuel in double bottoms, 900 cubic meters; speed (trial trip), 11 knots; service speed, 10½ knots; normal power 2,400 shaft horse-power. Those equipped with Diesel motors consume 10½ tons (73 barrels), of heavy oil containing up to 20 per cent pitchy and tarry matter, per 24-hour day at 11 knots speed, or 0.45 pounds per hour per effective horse-power, and 0.017 pounds of lubricating oil per hour.

These vessels are the "emergency ships" of Italy, but their builders are planning them for more than emergency; they say frankly, that when the war ends, and they find themselves with a great fleet of such vessels in their possession, they will compete for the trade of the world. They believe that after the war Italy will be one of the most fertile fields in which American capital can interest itself and American exporters will have there an unprecedented opportunity for business; they will, therefore, sell none of their steamers but will keep them to handle their share of this American trade.

Not only this, but they are ready as soon as a peace treaty is signed, to begin building in some of the twenty-two ways of their shipyards swift trans-Atlantic liners to compete for the passenger business of both North and South America. The great importance of this gigantic ship-building and engineering program which the brothers Perrone are carrying out so successfully is that it is purely Italian. Every cent of the capital is Italian, the directorate and management of every branch of the firm is Italian; and it would use only Italian materials if this were possible, but as there is no coal in Italy and as hitherto the little island of Elba is the only spot in the country where iron was to be found, they have had to obtain the greater part of their raw material from America. The exploitation of the Cogne iron mines is still only an experiment. If it turns out as well as the company hopes, it will supply at least some of the needed metal; but if it should not turn out well the firm will have to continue to look to the United States for its iron and steel.

The launch of one of these steamers at Sestri Ponente or Cornigliano Ligure is one of the most picturesque sights that can be imagined, and it is a launching that can be witnessed by tens of thousands, for it is visible from all along the sea shore. The Ligurian Alps form a blue background; the stately city of Genoa, with its palaces of marble that have been the headquarters of Italian maritime trade for 500 years, rises from the beach among blooming terraces and green slopes; the shipyards and docks are decked with flags, the shore is lined with spectators, and the calm surface of the sea is dotted with rowboats, while the stately warship or the robust freighter slides swiftly down the greasy ways and takes her initial plunge into the green water that is henceforth to be her home. Nowhere else in the world can a launching be so beautiful, but in these last two years it has become almost an everyday affair.

A Necessary Document in Foreign Trade

(*Concluded from page 110*)

have been awaiting shipment at Pacific ports. They were started from inland points at a time when American manufacturers and exporters were selling everything for which there was a foreign market, regardless of available ship tonnage, rates, war contingencies, or any other factor. All the goods held by these 500 cars were covered by through bills of lading issued to the manufacturers and jobbers in New York, Chicago, and other cities; the bills have been negotiated and the money has gone into circulation. But for the through bill of lading, such a congestion of export shipments would have caused chaotic financial and commercial conditions. Domestic bills of lading would not have been negotiable, because the goods were consigned to foreign countries, and the shippers would have had neither their wares nor their money.

The through export bill of lading should be retained if the Government can see its way clear to do so. It is such a prime factor in facilitating the financing of foreign trade that even if war exigencies require its discontinuance efforts should be made to find a temporary substitute.

Brightening the World

THE remarkable increase in exports of electrical goods from the United States during the past five years shows that our manufacturers have not ignored their opportunity to replace German products of this kind in the world's markets. With a gain of more than $15,000,000 in 1916 and an equal advance in 1917, we shall this year exceed Germany's shipments in 1913 if our rate of progress is maintained.

Our foreign trade in incandescent lamps with metal filaments is growing by leaps and bounds. During the fiscal year 1913 we sent abroad 1,363,493, valued at $394,692; in 1917 we exported 10,703,531, worth $2,143,802. Canada, Brazil, Cuba, and Argentina each bought more than a million of these lamps in the latter year, while Mexico took almost as many.

Lamp manufacturers in the United States should be able to compete for Australian business, though a five per cent tariff must be overcome. The bayonet base is used mainly in Australia. The general use of 200 volts may be a handicap for American makers, as they are not accustomed to turning these out in considerable quantities.

In all the larger cities of the states of Sao Paulo and Parana, in southern Brazil, modern plants generate electricity for both light and power. The hydroelectric plant in the city of Sao Paulo produces 16,000 kilowatts, and the American Consul reports that all styles of equipment in use in the United States are adapted to that region. There is a constant demand in the state of Rio Grande do Sul for plain lamps and fixtures, the trade being principally in the hands of the hardware dealers.

Although Cuba is constantly increasing its purchases of incandescent lamps, American manufacturers are not assured of their present share of the trade after the war, for European lamps were gaining in popularity up to 1914, when Germany sold more than $500,000 worth, compared with less than $200,000 worth in 1912. The designing of lamps for the same

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The New Stromberg Carburetor is never at mercy of outside conditions. "Internally" right in construction and eternally right in action. Insures most miles per gallon and least cost per mile ALWAYS.
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capacities a d voltages that foreign makers have popularized, the selection and marking for the voltages actually encountered on the various circuits, the price, and the quality should all be given careful consideration.

Most of the lamps sold before the war in Eucador and Peru came from Europe. House lighting in these countries is furnished by single drop lamps suspended from the ceiling. The former market is peculiar in that a well-established gas plant, located in Guayaquil, limits the sale of electric lamps in one of the two largest cities. Electric fixtures are in little demand in either Ecuador or Peru, although in the latter country some chandeliers and table lamps find a sale in Lima and Arequipa. Exports of metal filament lamps from the United States to Ecuador increased from $1,358 in 1913 to $6,665 in 1917; to Peru, from $10,801 to $21,437 during the same period.

The use of electricity in Uruguay has been encouraged by the government through a permanent electrical exhibit at Montevideo. More than 300,000 American lamps were imported in 1917, against 22,000 in 1913. The voltage at Montevideo is 220 and alternating current is employed. Colonia, Canelones, Maldonado, and Pando are other places having lighting plants.

Electric Weighing of a Moving Mass

(*Concluded from page 111*)

which gave satisfactory service under a coating of an inch or so of fine dust, accumulated over a long period of time. Everything else is electrical; and heavy insulation is sufficient to protect the business parts. It is for this reason that the scale stands up so well under hard usage.

A wide variety of useful and interesting collateral operations may be performed with these conveyor scales. One obvious development is a clock attachment to regulate the flow. This works on familiar principles. A constant flow of, say, 10 tons per hour means a constant current consumption by the metering circuit of so many amperes per hour. The clock is in circuit with this measuring current in such way that when the rate of current consumption falls below or rises above the proper figure, the rate of travel of the belt is accelerated or retarded, as the case may be. Then, whatever the irregularities in the loading of the belt, it will carry the desired 10 tons per hour past the scale pan, adjusting these loading discrepancies by varying its rate of travel.

A direct outgrowth of this is a scheme for controlling the flow of materials into a mixing chamber, and thus insuring a uniform mixture. The principle is exactly the same, except that for the clock is substituted a second conveyor. One conveyor is the master; and the clutch that governs the connection is so adjusted that current consumption by the second machine shall be held in fixed ratio to that of the master. Then the weights of material delivered by the two will hold fast in this same ratio. This attachment is not confined to the simple case where two ingredients are to be mixed; a single master conveyor can thus regulate the rate of delivery for an indefinite number of others, and make possible an accurate mixture to any degree of complexity.

An obvious development is a graphic record operated off the measuring circuit. By this means one can make the conveyor tell its whole day's history—at what rate it was delivering material every minute of the day, when it was running at maximum and minimum, when it was standing idle—anything, in fact, that a superintendent might want to know about it. This, of course, is in addition to the normal installation of a totalizing ampere-hour meter which tells us how much material has been delivered since starting. In connection with this normal treatment of the case, however, must be mentioned the automatic stop, which cuts off the operating current and halts the conveyor at the moment when it completes the delivery of the amount for which the stopping mechanism has been set.

There seems hardly any limit to the variety in which the conveyor scale, either of the straightforward totalizing type or with one or another of its complications, can be advantageously employed. We illustrate a typical installation found at a big eastern railroad pier, where it is used to discharge cargo from ship to pier or vice versa, weighing it as it passes. The large structure in the foreground is the cab from which the device is operated, and contains also the weighing mechanism. It will be noted that this cab is mounted on a truck which runs on rails, quite independently of the conveyor belt itself. It can accordingly take up its position at any point along the belt, diverting the material to or from the belt at that point, weighing it as it passes, and placing it in the car, getting it out, as the case may be, by means of the secondary conveyor projecting toward the reader. The latter, it is hardly necessary to say, can be operated at any horizontal or vertical angle. In this way every car or a train can be loaded or unloaded without shifting the train or the big conveyor belt at all—the latter, in fact, is not movable. It is sufficient to shift the big truck containing the business end of the machinery.

Scope of Trade Mark Registrations

(*Concluded from page 112*)

This ruling was in conflict with the rulings of the Patent Office which were reversed. The Patent Office rulings, while acknowledging certain similarity between the trade marks in question, stated that the arguments were not convincing that the whole marks were so similar as to be likely to cause confusion in the trade. It will be seen that by the ruling of the Court of Appeals the scope of a trade mark registered in the Patent Office has been broadened and an additional burden has been placed on an applicant who endeavors to register a trade mark which resembles a trade mark previously registered. Rulings of this character increase the value of our registered trade marks.

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The earliest possible information of changes of treatment are sent to the Surgeon-General's Office from the American Expeditionary Forces, and these in turn are immediately transmitted through the classes and by means of moving pictures, lantern slides, and pamphlets to every surgeon who comes in contact with these wounds either at home or at the front.

Since last October more than 150 officers have received special instruction each month in classes which have been established at the War Demonstration Hospital, Rockefeller Institute; four classes at Bellevue Hospital, New York; Roosevelt, New York; University of Pennsylvania, at Philadelphia; Rochester, Minn.; Pittsburgh; Chicago; New Orleans, and San Francisco.

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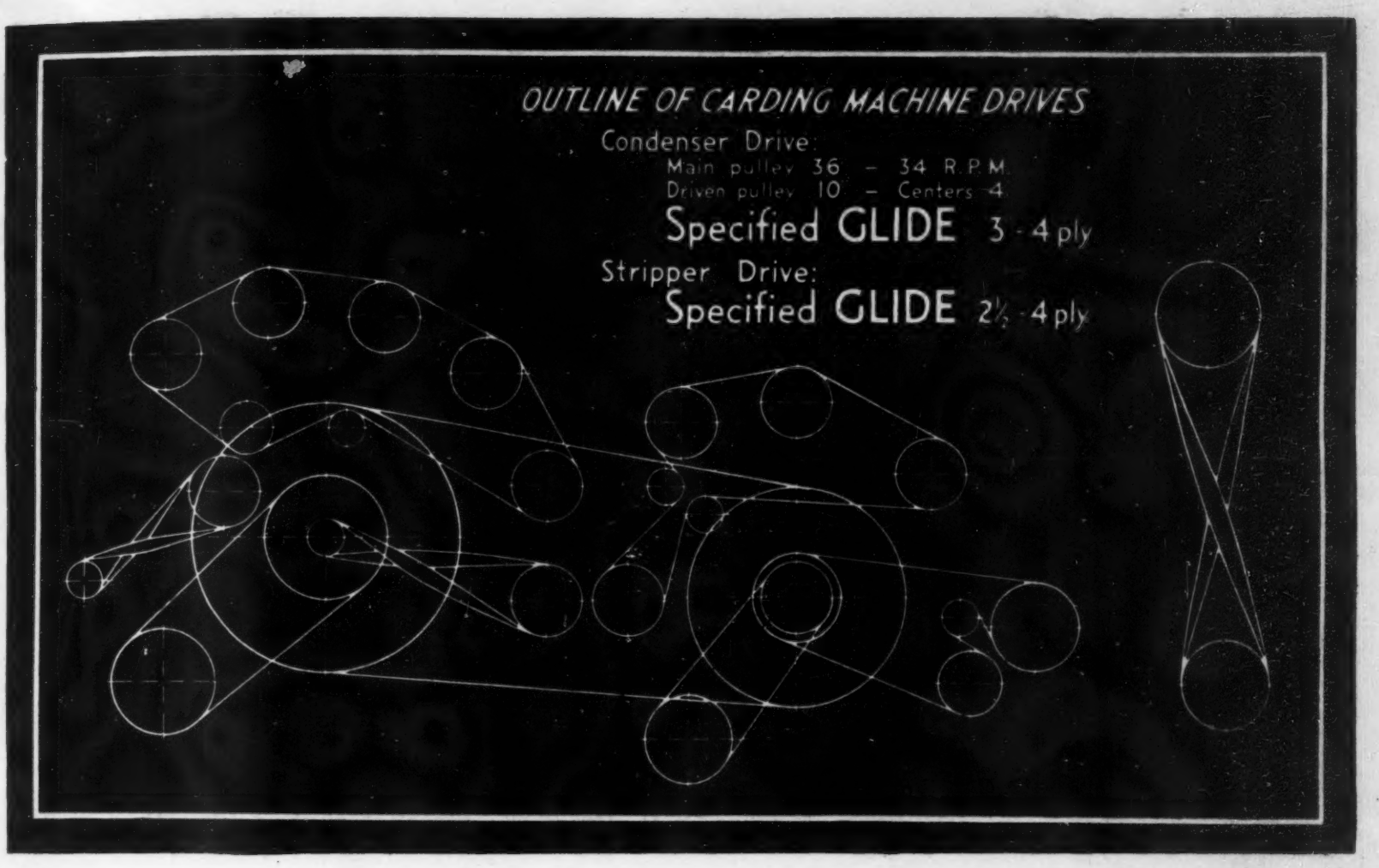
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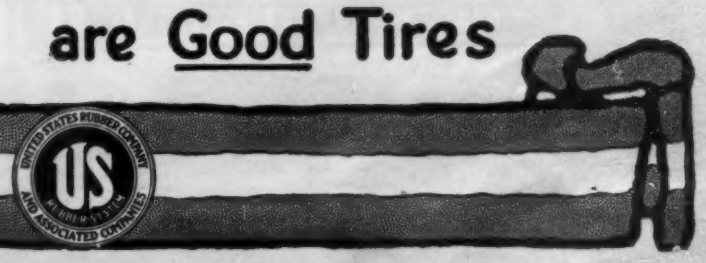

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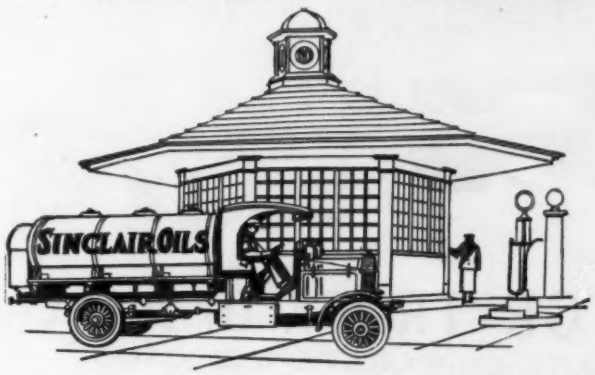

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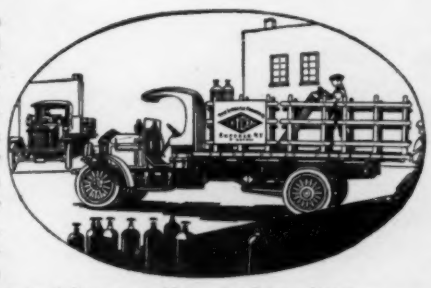

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